THE IRON TRADE REVIEW

VOLUME XXVIII. CLEVELAND, O. APRIL 4, 1895. CHICAGO, ILL. NUMBER 14.

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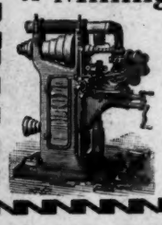

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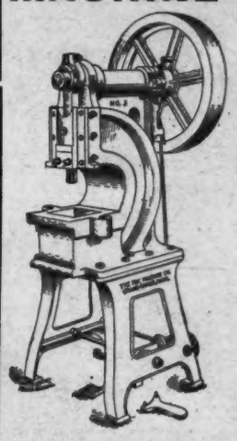

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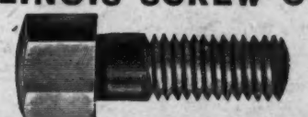

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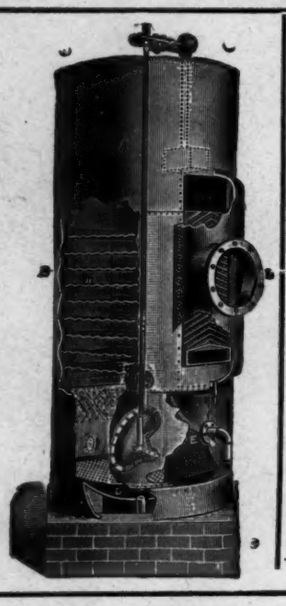

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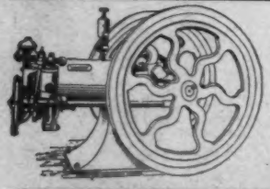

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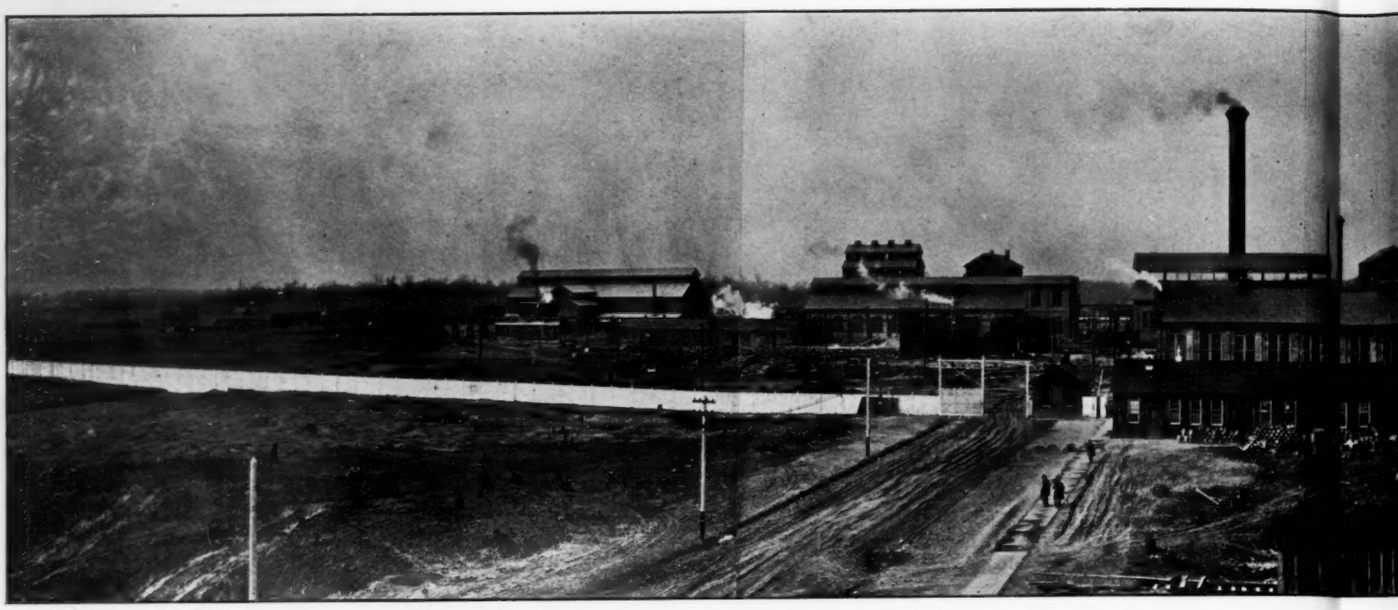
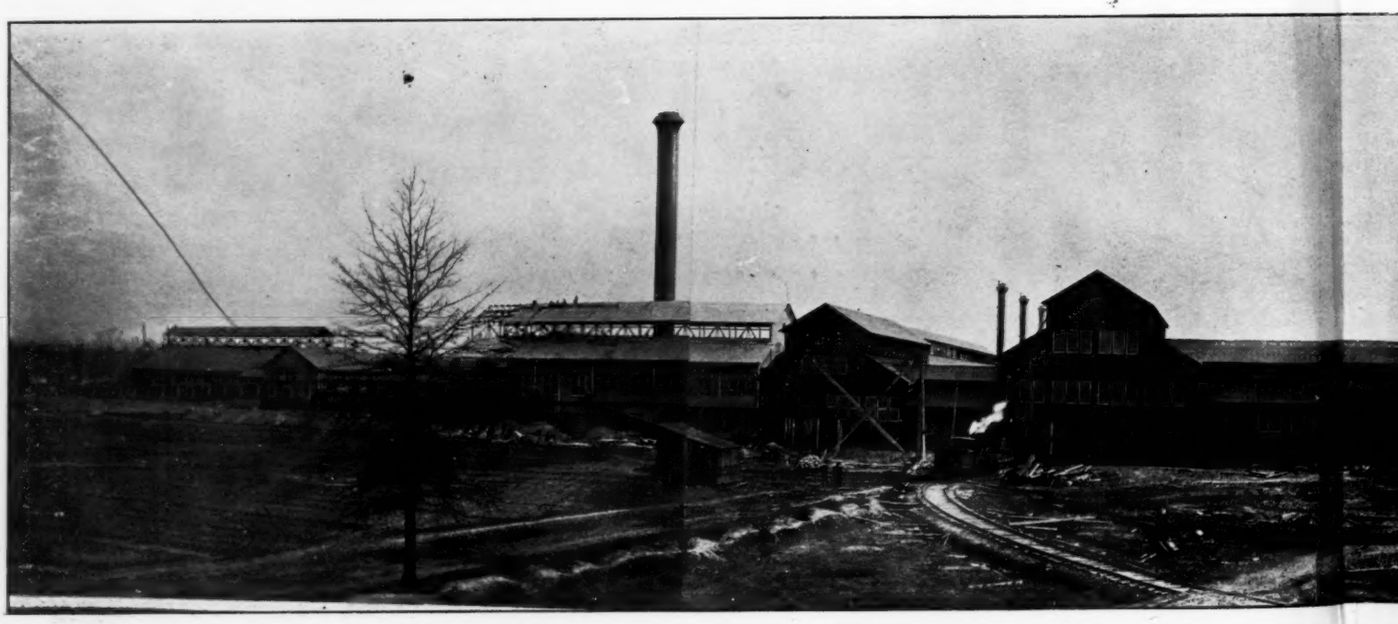


1. PHOTOGRAPHIC VIEW OF THE STEEL PLANT LOOKING FROM THE

Bottom House. Cupola House. Converter Building. Boiler House. ht Furn
Gas Pr
Power House. R

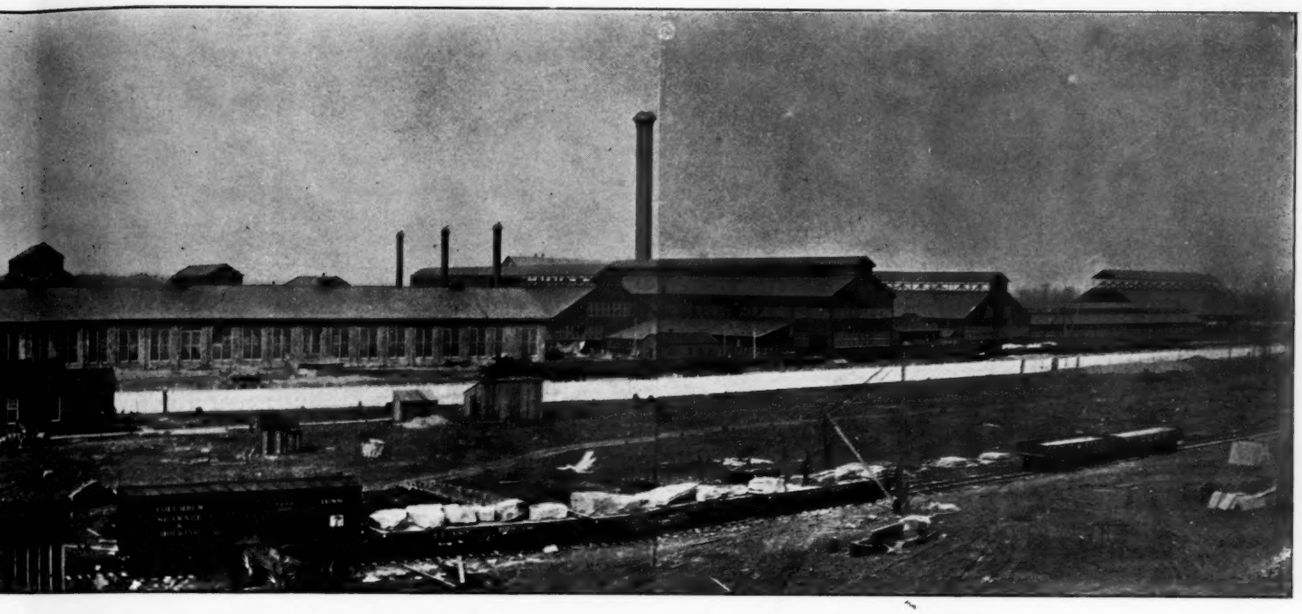


2. PHOTOGRAPHIC VIEW OF THE STEEL PLANT LOOKING SOUTH F

Finishing Building. Splice Bar Shop. Shape Mill Boiler House. Heating Furnace Building. Blooming Mill.

STEEL PLANT AT LORAIN, O.

t Blow, Monday, April 1, 1895.



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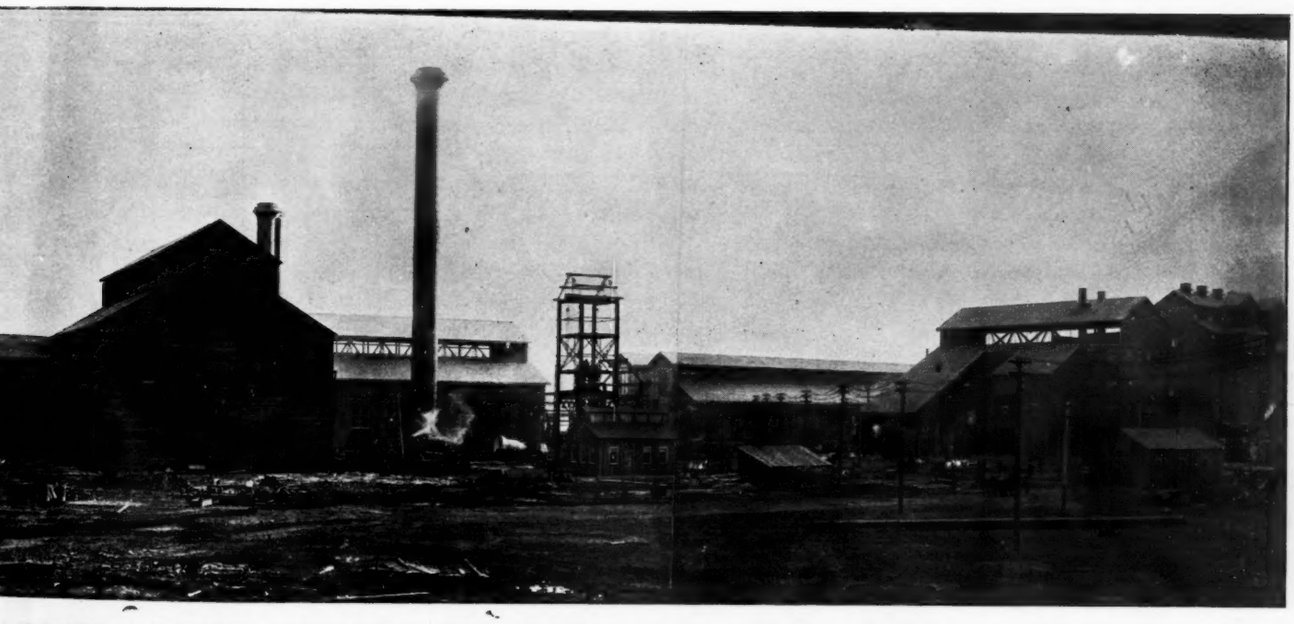

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THE IRON TRADE REVIEW

VOLUME XXVIII. CLEVELAND, O. APRIL 4, 1895. CHICAGO, ILL. NUMBER 14.

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Some large sales of Lake Superior Bessemer ores have been closed the past week, the total running up to 3,000,000 tons, of which about 1,000,000 tons has been sold in the past day or two. The advances established range from 10 to 25 cents above the prices of last year. A leading Western steel interest is the principal buyer thus far. The coke advance to $1.35, together with that on ore, means close to 75c added cost on every ton of Bessemer pig iron. Makers of Bessemer are much firmer in their position, in view of this situation and while the quotation of $10 at valley furnace was about 15c above market transactions last week, offers of $10 at the furnace for May and June deliveries are now refused. Some Pittsburg sales are reported at $10.75. Furnaces that had $9.50 in the valley as their minimum under the old prices would have to maintain a $10.15 or $10.25 figure under the new coke and ore basis. Owing to the fact that a few low-priced coke contracts are still running and that some furnaces have ore to carry them two or three months ahead, there will be some unevenness in the market in the next few weeks. Southern furnaces will now have an advantage in competition with Northern foundry irons, which may give the former a larger share of Northern business. But Northern foundry brands have scarcely responded to the coke advance as yet, though it is well known that cost has been reached, even with coke at 90c and $1. It would seem that some furnaces will be forced to go out until the market can be adjusted to the new basis, if such a thing is possible. While the Western bar iron manufacturers have not arranged the details of their agreement, the fact that they have agreed to form an association is significant, and the settlement of the valley iron scale without the wage reductions at first insisted on by the manufacturers is a hopeful sign. Though better prices in finished material have not been attained yet, the tendency is in that direction. Iron mills are paying more for scrap, and mill iron has shown greater firmness, with an actual advance in some markets. Soft steel billets, which shared in the advance in Bessemer pig a few weeks ago and then fell off, are now advancing again, and Pittsburg sales were made $15.25 and $15.35 the past week. Demand for finished material is still encouraging. Further rail buying is promised for the near future, and bridge work has been furnishing a large tonnage.

THE CLEVELAND OUTLOOK.

The week has been a busy one for iron ore selling firms. Sales made to date run close up to 3,000,000 tons of old-range Bessemers and a well known ore entering largely into Bessemer mixtures. The advanced prices which have been discussed for the past three months, ranging from 10 to 25 cents above those of last year—in most cases 10 to 15 cents—have been established by these transactions and at this writing there is increasing inquiry by buyers of Bessemers for the more desirable ores of the older ranges. Norrie at $2.90, Aurora at $3, Chandler at $3.05, Chapin at $2.55 represent the range of prices obtained. The largest purchases thus far made are for Chicago delivery. The leading Pittsburg interest entered the market early this week and has covered its wants in part. Some Shenango Valley and Wheeling district furnacemen have bought most of their year's supply and representatives of Mahoning valley firms are opening up negotiations. Blocks of Mesabi ores are included in some of the deals now pending, but prices have not been estab'ished for the new range. On a basis of $2,75 for Franklin and $2.65 for Biwabik, which are the quotations on two leading ores of the range, the indications are that the best Mesabi ores will fare better than in 1894. On those less sought for competition will fix the price. In the vessel market, the 75c short-season charters reported last week have been followed by season charters at 80c from the head of the lake, and upwards of 1,000,000 tons from Duluth, Ashland and Two Harbors has been placed at that figure. Some Marquette ore has been covered at 75c.

Pig Iron. The Bessemer pig iron market is largely an asking market, the uncertainties of the situation causing a wait on both sides. Valley producers are now refusing $10 on May and June metal, though a few Pittsburg sales are reported at $10.65 the past week. Some speculative coke has been on the market, and this together with the supplies accumulated by some furnaces and the low-priced contracts of a few, that run up to July 1, has delayed purchases at $1.35. While all the operators have granted the wage advance, there is a disposition by coke buyers to await developments, and no contracts are reported at the new figure. If it can be maintained, the cost of coke and ore for a ton of Bessemer iron will be increased 65 to 75 cents under the new order of things. Some assistance in maintaining the advance on Bessemer is expected from the lessening of production. With one Bessemer producer out in each valley, one in the Wheeling district and one in the Cleveland district, and the prospect that three Pittsburg stacks wil be out in April, the accumulation of metal will be retarded. Foundry iron has scarcely felt the upward movement in coke, though some Northern sellers are firmer in maintaining a minimum. Forge iron shows a better demand with a shade advance in price.

Finished Material. The outcome of the meeting of 25 Western bar iron manufacturers in Cleveland lass week, representing 80 per cent of the tonnage west of Pittsburg was a decision to form a Western bar iron association. The scope of the organization will be more definitely determined at a Chicago meeting this week, but it is understood that a better price basis will be the result and that contract-breaking and other abuses will be checked. The decision of valley manufacturers to continue the old scale of wages is another element of strength. Specifications on contracts are coming in faster to the mills and several orders have been taken in the Cleveland district—three of these aggregating about 1,500 tons. An advance of $1 a ton is asked by some sellers, with a prospect of further strengthening under improved demand. Steel mill products have been in only moderate demand, at unchanged prices. A Toledo building calling for 1,000 tons will go up at once, but the general building demand is not strong.

THE CHICAGO OUTLOOK.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

The advance in the price of coke has caused a bullish feeling among both buyers and sellers in this market, and while as yet no prices have been advanced, it seems probable that they will be a little higher all along the line in the course of the next 30 days at least. Sales in the last week were larger than those of the week before for nearly all classes of material. The demand for both raw and finished material is steadily increasing, and indications point to a better business in the future.

PIG IRON.—Sellers of all grades of pig iron incline to the opinion that prices will be higher in a short time. Northern iron will be advanced within the next two or three weeks, probably, because of the higher prices asked for coke. Southern iron has been for some time a little weak as to price, but it seems to be rather firmer this week, and it is quite probable an advance in quotations will be made in the near future. Sales of Northern iron were considerably larger last week than in the week previous; orders ranging from 1,000 tons down. There is still large inquiry. One furnace reports having received a larger aggregate of orders in the past week than in any week for several months. Southern iron sold exceptionally well; among the orders placed being one for 1,000 tons and several for 500 tons each. Inquiry continues large, and several more large orders are expected to be placed in the present week. Lake Superior charcoal is quiet, but there is a rather better demand for it. No sales of any size, however, have been made. Quotations are unchanged and are as follows:

Lake Sup. Charcoal	$13 00@13 50	Southern No. 2 Soft	$ 9 75@10 00
Local Coke Fdy. No. 1	10 25@10 50	South'n Silveries No. 1	11 50@11 75
Local Coke Fdy. No. 2	9 75@10 00	South'n Silveries No. 2	11 25@11 50
Local Coke Fdy. No. 3	9 40@ 9 65	Jackson Co. Silveries	15 00@16 00
Local Scotch Fdy. No. 1	10 25@10 50	Ohio Silveries No. 1	14 00@14 50
Local Scotch Fdy. No. 2	9 75@10 00	Ohio Silveries No. 2	13 00@13 50
Local Scotch Fdy. No. 3	9 50@ 9 75	Ohio Strong Softeners	12 50@13 00
South'n Coke No. 2	10 00@10 25	Alabama Car Wheel	17 50@18 00
South'n Coke No. 3	9 50@ 9 75	Malleable Bessemer	11 00@11 50
Southern No. 1 Soft	10 00@10 25	Coke Bessemer	11 00@11 50

BARS.—The week was unexpectedly quiet, as it had been supposed that two or three large orders hanging fire for some time, would be placed. They were not, however, although it is probable they will be within a short time. It is reported that the M., K. & T. Ry. placed an order for 1,000 cars with a Southern car works last week. General business was rather quiet, although there continues to be a good inquiry. Prices continue firm, and are made at 1c for common iron; 1.10c to 1.15c for guaranteed, and 1.20c for soft steel bars from strictly billet stock.

RAILS AND TRACK SUPPLIES.—The situation is unchanged, and sales were made in the last week of about as large a tonnage as has been placed weekly for some time. Quotations are maintained at $23 to $25 for rails; splice bars, 1.25c to 1.30c; track bolts, 1.95c to 2c; spikes, 1.65c to 1.70c.

BILLETS AND RODS.—A sale was made last week of 10,000 tons of billets at $16.50. This clears the market of all inquiries. No sales were made of rods, which are still quoted at $23 to $23.50.

STRUCTURAL MATERIAL.—The bids for the bridge material for the track elevation of the Rock Island Road are expected to be opened in the present week. The Northwestern Road will soon be in the market for material for the elevation of its tracks. General business is quiet, but sales are larger than for some time past and increasing all the time. Quotations are unchanged, as follows: Beams and channels, 1.45c to 1.50c; angles, 1.30c to 1.35c; plates, 1.35c to 1.40c; tees, 1.65c to 1.70c. Small lots from stock are quoted at ¼c to ½c higher.

PLATES.—Business has been quiet and no orders of any size have been placed. A good store business is done and inquiries are still numerous. Quotations are made as follows: Tank steel, 1.25c to 1.35c; flange steel, 1.50c to 1.75c; firebox steel, 2c to 5c; boiler tubes, 75 to 77½ per cent discount.

MERCHANT STEEL.—Business has been comparatively quiet, but specifications are being received on season contracts in good shape. Prices are unchanged: Open-hearth spring, tire and machinery steel, 1.55c to 1.60c; smooth finished tire and machinery, 1.50c to 1.60c; Bessemer bars, 1.35c to 1.40c; tool steel, 5.50c to 7.50c; specials, 11c and upwards.

SHEETS.—The inquiry for black sheets is not quite so large, although a few good orders were placed in the past week. Quotations are made at 2.25c to 2.30c for No. 27 common, Chicago. Steel sheets are quoted at 2.35 to 2.40c. Galvanized sheets are in fair demand with quotations unchanged at 80 per cent discount.

OLD RAILS AND WHEELS.—The market has been very quiet, and no sales of any consequence were made last week. Old rails are quoted at $10.50 to $11; old steel rails at $7.50 to $9.50 according to length, and old car wheels at $8.75 to $9.

SCRAP.—Business in the last week was a little quieter, and no large sales are reported. Prices are unchanged as follows: Railroad forge, $8.50 to $9; dealer's forge, $7; No. 1 mill, $6.50; No. 1 machinery, $7; axles, $12 to $12.25; cast borings, $3.50; wrought turnings, $5.25; axle turnings, $6.25; mixed steel, $5; heavy cast, $7 to $7.25; stove plates, $5 to $5.25; heavy melting steel, $7 to $7.50.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Pittsburg. Negotiations are in progress between ore firms and a large buyer of ores that if concluded will mean the adding of upwards of 1,000,000 tons to the total already contracted for for 1895 delivery. It is understood that in the earlier sales the advanced prices were established, making the basis $2.90 for Norrie, and $3 for Aurora. The announcement of $1 35 as the price of coke was a surprise to most furnacemen, but it would appear that the figure is to be maintained. All the operators in the Connellsville region advanced wages to the new basis April 1, though some of them are known to have 90c and $1 coke contracts on their hands running to July. There are not many of these, however. In the past week sales of Bessemer iron have been made at $10.50 to $10.65. The latter figure is firmly maintained to-day. Valley producers are refusing $10 at furnace for May and June deliveries. Bessemer steel has scarcely kept pace with pig iron, but is firmer to-day. A sale of 2,000 tons is reported at $15.25 maker's mill and one of 1,500 tons at $15.35. Foundry iron has not shown any greater firmness as yet; forge iron has advanced slightly, 15 to 25 cents increase being secured over prices of two weeks ago. The mills report some improvement in finished material. The decision of valley makers of bar iron to withdraw their demand for a reduction in puddlers' and finishers' wages and the movement among Western bar iron manufacturers for better prices have given considerable strength to that market. The demand for black plates for tinning is fully up to the supply; sales are noted at $2.75. Scrap is active, with a considerable advance in some directions.

Cincinnati. The past week has witnessed a market fairly satisfactory in volume of business and prices obtained. There are still irregularities in demand, and

reports from some sections indicate dullness and depression while considerable activity is noted in other quarters. Considering the country as a whole, the many orders received for small amounts and quick delivery show that the consumption of iron is growing steadily. Buyers, as a rule, are willing to keep their stocks low and depend on the furnaces to ship as needed. Some of the larger consumers have seen fit to cover requirements for the remainder of the year. The rank and file of the trade have not done so. Should a legitimate advance in prices be established, either by reason of the increased cost of coke or better demand, there would be a rush to cover that would clean up stocks and put quotations on a higher plane. There is considerable difference in the views of sellers, but most of them are acting very conservatively. A few have put their figures where they cannot hope for orders now, but the majority of producers are willing to book contracts on present basis for delivery during a reasonable time. It is thought best to allow accumulations to be moved and the fact established that this is a genuine improvement and not a spurt. It would seem that buyers will not loose if they cover their wants for the next four to six months by contracting for standard brands at the low range of values now existing.

Buffalo. The air of activity still continues with prices as much depressed as ever. There is a disposition on the part of Northern furnaces to hold off from answering future delivery inquiries until they can see farther into the future of raw materials, but Southern furnaces are crowding for business of any sort which meets their limit in price, and consequently have booked considerable amounts. While the signs of the times are encouraging, the realization of hopes is painfully deferred.

Lime, Magnesia and Sulphur in the Blast Furnace.

The interesting discussion which is being carried on concerning the effect of magnesia on sulphur in blast-furnace cinder has brought out many advocates on each side, some claiming that the high-lime cinder will remove sulphur more effectually than high magnesia, and others taking the opposite ground. Probably the difference in opinion comes from a difference in practice. It is a well known fact among furnacemen who have been able to use a slightly dolomitic limestone, that to carry about 8 per cent magnesia in a 34 or 36 silica slag gives better results so far as the removal of the sulphur is concerned, than a cinder which does not contain magnesia. The practice in the South was for a long time confined to the use of non-magnesia limestones, but when some furnacemen became bolder and tried magnesia the results were so much better that it may be said to have gone into general use. For mill irons it is not likely that magnesia would give such satisfactory results, but for foundry irons it undoubtedly does, and it might further be added that when it is necessary to run on a highly basic cinder, if it contains about eight per cent magnesia it will not slack, whereas a lime cinder of the same basicity would slack while almost red hot. This is particularly noticeable when making spiegeleisen.—[Engineering and Mining Journal.

FROM its department of forges and blacksmith's tools the Buffalo Forge Co., Buffalo, N. Y., has sent out recently its quarterly instalment of illustrated literature to blacksmiths, not only in the United States, but in foreign countries. The folder accompanying the makers' letter gives interior views of blacksmithing shops, the smith shop of the Toledo Manual Training School, Toledo, O., being conspicuous. A long list of manual training schools and col'eges in which the smithing equipment is of Buffalo Forge Co. make is given, and there are detailed descriptions of the Buffalo forge, drill punch and tire-upsetter. Some idea of the extent of the field covered by the Buffalo "blacksmith letter" and accompanying literature may be gathered from the statement that 300,000 circulars are employed in the present distribution.

ARRANGEMENT OF POWER EQUIPMENT.

Three general methods of arranging machinery of power stations are common in the United States. In one the power is transmitted from the prime mover to a line shaft, and thence by belting, to the dynamos. This we will call the line shaft system. In another the power is transmitted by a belt or rope from the prime mover directly to the dynamo. This we will term the direct-belted system. In the third the shaft of the dynamo or generator is directly connected to the prime mover, and has the same speed of rotation. This we call the direct-connected system. Regarding these several systems, it may be said that local conditions or surroundings may be such as to render it advisable to adopt one or the other. The writer, however, believes that it will be seldom or never necessary under present conditions of manufacture to adopt or use the line shaft system. That system is objectionable for various reasons.

The direct-belted system is today the cheapest in first cost and in many respects the most satisfactory to operate. The arrangement of the generators, distinct from the prime movers and connected by flexible connections, makes it possible to repair accidents with great facility and convenience. In general, with this system, only one or at most two generators can be driven from an engine without the use of riding belts. With the condition of the market as at present, however, with generators available of any size required, this matter is of little practical importance.

The direct connected system is without doubt the ideal system, since transmission losses are eliminated and the power occupies a minimum amount of space. The cost today would be about 20 per cent in excess of the direct-belted, but not essentially greater and possibly even less than that of a well constructed line shaft system. The American practice in building direct connected machines is to extend the main shaft of the engine and suspend the generator armature on the end, either with or without an out-board bearing. The English system is somewhat less rigid, the engine shaft being connected to the dynamo shaft with a coupling.—[Prof. R. C. Carpenter in Cassier's Magazine for April.

Personal.

W. P. Powell, of Milwaukee, formerly in the employ of the Illinois Steel Co., has been appointed to represent the Consolidated Steel & Wire Co., in London. The announcement in the daily press that he will represent the Illinois Steel Co. is incorrect, but it is understood that he will keep the latter company conversant with the condition of the steel trade abroad and with the drift of English prices in its lines of production.

J. P. K. Miller, who for a number of years has been chief engineer of the McClure Coke Co., has accepted the position of chief of the engineering department of the H. C. Frick Coke Co., with headquarters at Scottdale, Pa. This is the position that was made vacant by the death of J. H. Paddock, who was killed by strikers at Davidson mines, near Connellsville, about a year ago.

Supt. Chas. M. Schwab, of the Homestead steel works, sailed from Southampton for New York last week. He was banqueted by London friends just before starting for home.

MATTHEW MARSHALL, in the New York *Sun:* "There is no disputing the fact that the wealth of the civilized world has so greatly increased, and the opportunities for its profitable investment have so much diminished, that a much lower rate of interest has to be accepted for its use. In Europe, within 50 years, three per cent per annum has taken the place of five per cent, as the income with which capitalists are obliged to be contended, and our old fashioned seven and eight per cent has gradually sunk first to six per cent, then to five per cent, and now rests at three per cent to four and one-half per cent on good security."

THE Steel Barge Co., of West Superior, has been asked by the Standard Oil Co. to prepare estimates of cost for the construction of two more barges for carrying oil in bulk and also for the construction of a steam barge designed for towing the oil barges.

THE IRON TRADE REVIEW

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APRIL 4, 1895.

A TIME FOR CONCILIATION.

The starting of the Montpelier (Ind.) Sheet & Tin Plate Co.'s new plant after a banquet in which employer and employed broke bread together and listened to music and speeches, and the ready agreement of manufacturers and men at Youngstown on the continuance of the present puddling and finishing scale, are two recent incidents that merit special mention. There is little enough of this sort of news to print in recording the transactions between employers and wage-earners. Just now, as the signs of better conditions are thickening—though not so thick yet as to make authorities unanimous about them—there is need of utmost conciliation and restraint in the handling of the wage questions that are coming up in various directions. In New York, a strike starting with electrical workers and involving thousands of men in the building trades, has ended in the complete defeat of the men; and it cost them hundreds of thousands of dollars to find out that the demand made was ill-timed and entirely unwarranted by conditions. It is not likely to be the only futile attempt to force the return to better times by imposing advances which employers cannot grant; and on the other hand, the failure of this strike is not to be taken by employers everywhere as justifying the refusal of any and all demands for higher wages or shorter hours. There was a vast difference between various industries in the time that elapsed before the panic's blight was plainly upon them; so there will be great diversities in the rate of recovery. Because a wage advance is granted in one line is no indication that a demand for better pay is justified in another.

It behooves employers and employed to study closely the developments in industry. There will be many deceptive surface signs, and much jumping at conclusions, especially as the policy of the daily press has been in the past two years to give more prominence than ever to events in trade and industry. It is well to remember that whereas columns were taken up daily in the newspapers, as the stringency tightened upon the country, to news of failures and shut-downs and wage reductions, the news of increasing working forces and of increasing wages will come in littles, bit by bit, and scattered over a long stretch of months. The breaking of a leg and the mending of a broken leg stand in about the same relation in point of time that the descent of a country into panic conditions bears to the return to prosperity. There will be precipitate action by labor unions, no doubt, due to impatience at the long-delayed restoration of the former basis of wages. Doubtless, also, there will be stubborn resistance by some employers, of advances that can be afforded. No rule will fit all conditions. Each difference will have to work out to a settlement on its own merits. Yet with the larger chances that now exist for mistakes of judgment by labor, as to the ability of employers to pay and for refusals by capital to recognize labor's claims until the former scale of profits returns, there is need of the greatest tolerance on both sides.

Profits, where there are any, will be of small proportions for a long time to come; wages will also be lower; values of nearly all commodities are on a lower level. To the manufacturer with good security, money is available at the lowest figure in years; to the wage-earner living is cheaper than ever before. While there are inequalities in the situation, due to the uneven shrinkage of various classes of values in the depression—and some of these inequalities may be a long time righting—there will be fewer mistakes made if the spirit of the Montpelier banquet and of the Youngstown wage conference can be carried into wage discussions of the future. If suffering together furnishes a reason, certainly the capital and labor of the United States ought to find it easier to be tolerant and conciliatory in the settlement of differences that may come in the near future.

DIVERSIFICATION OF INDUSTRY.

The recent visit of the members of Minnesota's legislature to the iron mines on the Mesabi and Vermilion ranges, and the various iron bills introduced in that body, reflect the quickened interest of the State in the iron industry, in view of the magnitude of the Mesabi deposits. One of these bills provides for bonuses to blast furnaces established in Minnesota for the reduction of native ores, these subsidies to be paid out of royalties to the State from its iron lands. Another appropriates money to establish a State plant for experimenting with electric smelting. A third rebates 25 cents a ton of State royalty on ore reduced within the State. The object of all these propositions is to enlarge Minnesota's iron industry and to make that State more than a purveyor of iron ore. It is the same spirit that has inspired the efforts of the South to establish steel plants, rolling mills, foundries and hardware manufacturing plants within its borders so that it may not be compelled always to send the bulk of its pig iron hundreds of miles to the North, there to meet sharp competition that reduces the profits of its blast furnaces to the minimum, if it does not altogether wipe them out.

All such efforts are natural and commendable. In the South, the constant agitation of those who have insisted that its destiny had vastly more in it than the hewing of wood and drawing of water, has been rewarded with the beginnings of broadly diversified industry. The movement of certain cotton mill manufacturers out of New England is the latest and most significant development in this direction, but much else has been going on in recent years that has attracted less general attention because it has not been a movement in block, or at the expense of a particular section. What has been done thus far has been of great benefit to the South and has made further campaigning on the same line easier. Higher wages come with the processes involved in manipulating the crude material and carrying it into more or less finished forms. Expensive machinery must be employed every step of the

way, and with the introduction of machinery come foundries and machine shops and all the interdependent industries that increase almost in a geometrical ratio, as the lines broaden out.

The limitations upon the South, in its campaign of extension in finished production, are its lack of capital and the smaller average buying ability of its population as compared with that of the more thickly settled and more generally well-to-do sections of the North. The drawback in Minnesota to the movement proposed for the widening of her iron industry, is that nature has not been lavish enough. Minnesota has the ore but not the fuel. Much has been said in the rosy prophecies of enthusiastic Minnesotans of the possibilities of electric smelting, with the State's abundant supply of running water to drive the dynamos. But all that is a dream to-day, and any practical investigation of the subject must take into account the use of coke and flux. The cost of assembling these materials must be figured, as well as the cost of bringing the ore to the water's edge, for we take it that the plans contemplate the location of blast furnaces on the shore of Lake Superior. The cost of rail haul from the mines will thus be the same as on ore brought down the lakes, equivalent to-day to the rate on water haul all the way from Duluth to Lake Erie port. Against the $1.35 cost of bringing 1.7 tons of ore from Duluth to Lake Erie is to be put the lake freight on a ton of coke up, or the lake freight on coal to be coked at the head of the lake. But this is not all. Not only does the most favored site for manufacturing call for the shortest distance between sources of raw materials and the assembling point, but also the shortest distance between the manufacturing point and important consuming centers. While Lake Erie furnaces and steel works have some of the best markets in the country right at their door, iron and steel plants in Minnesota, if they sought to enter anything more than the limited near-by markets, must carry their product into the very districts in which the best equipped and most economically operated plants in the country are competing to-day, with the capacity for finished material largely in excess of the demand.

The problem is far from being the one-sided one that some of the Minnesota legislators fancy. It has been canvassed often by metallurgical experts and by capitalists seeking to invest for profit. The fact remains that thus far it has been found profitable to continue extending the smelting capacity of the lower lake region, while the single coke iron furnace in Minnesota had only a brief and profitless career.

THE contract for the 12,000 tons of rails for the San Joaquin road in California went to a Central Pennsylvania rail mill, the price being $22.75 alongside ship at Jersey City. There was not the square test that was looked for in connection with this business, of the possibilities of foreign competition in steel rails on the Pacific coast. It was expected that the order would go abroad, foreign mills having the better of the Pacific coast market under the new tariff; but it is stated that they were barred out in the present instance because of their inability to deliver the rails in time.

WE are informed that the negotiations of the Penn Iron Mining Co., in progress a short time since, for a Mesabi range property have been broken off, and the company is confining ts attention strictly to the Menominee Range.

FOLLOWING the attachment mentioned elsewhere, the Findlay (O.) Rolling Mill Co. assigned, April 2.

LORAIN'S STEEL PLANT.

The iron and steel trade of the country has scarcely ceased talking about the plans for the migration of an important producer from a familiar Pennsylvania habitat to a point over 200 miles to the westward—away from the coke and toward the ore—before the announcement comes that the new converters are blowing, and what was only in plan a year ago is to-day an accomplished fact. On June 11, 1894, the Johnson Co. began felling trees two miles east of Lorain, O., to clear a site for a great steel plant. On Monday night of this week, April 1, 1895, the fires were lighted in their cupolas, the blast turned into their Bessemer converters and before midnight the first cast of steel had been made. In 11 days less than 10 months a work has been wrought to which under ordinary circumstances quite two years would be allotted. And with the same marvelous system and dispatch of detail, it is entirely probable that when an even 10 months have expired, the finishing mill will have been completed and the first rail rolled. It is not necessary to comment here on the personalities back of this wonderful achievement, nor of the qualities they have brought to the task whose accomplishment is the marvel of all in a position to appreciate its proportions. Nor is any review needed at this time of the causes that led to the transfer from Johnstown, Pa., to the Lake Erie site, of a company that has the girder rail trade of the country practically in its hands. That is familiar ground to the readers of *The Iron Trade Review*. The starting of the new plant on the first day of this month according to the programme made weeks ahead, gives timeliness to some details concerning it that have not been published heretofore.

Following the various windings of Black River, the 86 acres fenced in for site and yards of the steel plant are something over three miles from the river's mouth. The bed of the river is nearly 50 feet below the level of the tract of land taken up by the Johnson Co, the bluff rising abruptly from the edge of the water for the most part, with now and then an interval of low land between the river and the high ground. The soil is clayey, and underneath it a shale of compact formation and distinct cleavage. The slope is slightly toward the river, giving good drainage. As the contractors have found to their satisfaction, the shale furnishes superb foundation when protected from disintegrating elements, and buildings and machinery are as firmly grounded as though on the solid rock.

By another year the river will be dredged to a depth of 17 feet as far as the docks the Johnson Co.will build in connection with their blast furnace and coke plants, plans for which are now under way. These are to be located west of the steel plant and thus nearer Lorain.

In following the description below of the various buildings of the steel plant, the reader will be assisted by referring to the panoramic view which appears in the Supplement accompanying this issue:

The first building, beginning at the left of the first view given, is the bottom house, which is 176′x95′. It contains two furnaces for the drying ovens, two sets of furnaces of four ovens each, for drying ladles. For grinding refractories there is a crusher driven by a Russell engine of 100 h. p. The ovens are served by a 15-ton Yale & Towne electric crane.

The cupola house, which like all the other buildings is of steel and iron construction, is next in order. It is 72′x45′, and equipped with four cupolas 25′ in height and 10′ in diameter. These are served by two Crane hoists. Special facilities are provided for dropping cinder, etc., into cars. The iron is run into a ladle on a car and conveyed to the converters. The latter are in a building 85′x90′. There are two, each of 10 tons capacity. Instead of the direct bolting of the trunions to the shell of the converter, the converter is banded by an outer frame of cast steel, and to this the trunions are secured. This gives air space and prevents such heating of the trunions as might interfere with ready manipulation of the converter. This outer steel frame is cast in two semi-circular parts, bolted together. It was the aim to have the frame in a single casting, but no steel casting company was found willing to undertake the contract. Converter bottoms are changed with the aid of a stationary hydraulic jack. A 20-ton hydraulic crane is provided for the ladles, the blow being cast direct in the ladle.

[Continued on Page 10.]

STUDY OF THE PHYSICS OF CAST IRON.*

BY WM. R. WEBSTER

In view of the great interest now taken in the tests of cast iron and details of foundry practice, with the number of investigators at work, and recent improvements in the methods of research, it would seem that the time is ripe to attempt the solution of some of the many problems with which iron founders have to contend. Recent papers and discussions on these subjects have opened up a large field for investigation, and have emphasized the importance of many considerations generally overlooked. With the view of promoting a comprehensive and systematic discussion, I have attempted to tabulate, in convenient form, some of the most important points for investigation, on the general plan suggested, with such good results by our former president, H. M. Howe, for the discussion on the physics of steel, at the Virginia Beach meeting last year. This table can, no doubt, be modified or enlarged to advantage, and put in shape to serve as a guide or reminder to all who are interested in this line of work:

I.—Correspondence between chemical composition and melting point, fluidity, shrinkage, fracture, chill, micro-structure, and other physical properties.

II.—*Influence of:*

1. Cupola mixture, use of steel and other scrap, oxidized or clean material,		
2. Manner of melting, flux, etc.,		
3. Casting temperature,		A. Fracture.
4. Manner of handling melted metal and method of casting,		B. Micro-structure.
5. Size and form of casting,		C. Physical properties.
6. Kind of mold, green sand (under different conditions of ramming, amount of moisture, and skin-dried), dry sand, loam, and chills,	on	D. Shrinkage.
7. Rate and mode of cooling castings,		E. Chill.
8. Manner and temperature of heating for annealing,		F. Residual stress.
9. Additions of nickel or aluminum,		G. Condition and quantity of carbon and other elements.

III.—*Segregation as affected by:*
1. Composition.
2. Casting temperature.
3. Rate of cooling
4. Size and shape of casting.

IV.—*Blow-holes, their volume and position as affected by:*
1. Composition.
2. Casting temperature.
3. Casting pressure.
4. Rate of cooling.
5. Size and shape of casting.
6. Special additions.

Instead of giving a review of what has been written on the most important of the above headings, I have induced several investigators and experts to contribute the results of their work and opinions. If these are fully discussed, and followed up by the results of others who are working in the same line, we shall soon accumulate a large amount of valuable material. That such material already exists there is no reason to doubt.

Several works have employed chemists, and struggled with these problems for years, but each one carefully guards the results; and at the present time many seem disinclined to add theirs to the common store. But, if they could be induced to make their methods and results public, by freely discussing them before this institute, they would be well repaid by the assistance they would receive through such an interchange. Nobody is as wise as everybody; and nobody loses, as a general rule, by a generous frankness which secures the criticism and help of others. The possible loss through giving to competitors a few shop secrets is really trivial in comparison.

I am fully convinced that the relations between the chemical constitution and physical character of cast iron are much closer than is generally admitted to-day. If proof of this is wanted, we have it in the success of those who have given up the old rule-of-thumb methods in running their foundries. There is no doubt that, in a full discussion and investigation of this kind, new data will be brought to light which, in connection with the results of the valuable researches already made, would enable us to make tables, and lay down rules for the founder's guidance, that would be of the greatest value to the makers and users of cast iron. In other words, from a cupola or furnace mixture, of known chemical composition, we could predict with certainty the physical properties of castings of any given size or shape (due allowance being made for change of composition in melting). Or, when certain physical properties were required in a casting of given size and shape, the chemical composition of the different mixtures that would produce these results could at once be given without any of the "cutting and trying" that we now have. This is not too much to expect; and it is not too much to hope that each will do his part in bringing about a result so beneficial to all.

*Read at the Florida meeting of the American Institute of Mining Engineers, March, 1895.

Commenting on the plan of investigation outlined in the above paper the *Engineering and Mining Journal* says:

The proposed scheme for the study of the physics of cast iron, an abstract of which is presented on another page, and which was read by William R. Webster, of Philadelphia, at the Florida meeting of the American Institute of Mining Engineers, now in session, is an important movement in the right direction. For ten years past there have been sporadic efforts to bring this matter to general attention. Prof. Turner and R. A. Hadfield, in England, and W. J. Keep, in this country, were the leaders in this movement, and their many excellent contributions have furnished a large amount of data, much of which has been practically applied by foundrymen. Unfortunately, so far there has not been sufficient attention paid to the close relation which must exist between the chemical composition and the physical characteristics. Prof. Turner's experiments were not sufficiently thorough nor extensive. Mr. Hadfield's work had special relation to the effect of the elements in the manufacture of steel, and Professor Keep has been hampered in his work by the lack of sufficient analysis to give his physical tests the value which they otherwise would have had. The various foundrymen's associations which have been formed within the past couple of years have taken the subject up in an enthusiastic manner, but they too have been prevented from forming any definite or practical conclusions by the incompleteness of the tests which they have taken under discussion. In order to carry out a work of the kind proposed by Mr. Webster (and it is one of far-reaching importance), it would be necessary to formulate a scheme for analyses and physical tests. That which is suggested by him is not sufficiently exhaustive, the melting point, fluidity, shrinkage, fracture, chill and micro-structure do not fully cover the ground. Mr. Keep's tests are broader than this, but to them should be added tensile, tortional and transverse strength, strength under repeated shock, and the various other physical peculiarities which are met with in complete chemical analyses. After these two divisions of investigation have been exhausted then it would be time to take up the plan Mr. Webster proposes.

There is much to recommend the procedure adopted by Mr. Keep in his early experiments; that is, taking as nearly a pure iron as he could get, and making to it successive additions of the elements whose effect he wished to study. The mistake which he made, however, was that each succeeding test was affected to a certain degree by the preceding test, since the material was either remelted or additions made to the melted metal. This should not have been the case; the only proper way would be to prepare a series of tests, each one separate and distinct, and each carried out under identically the same conditions. For instance, in the study of the effect of phosphorus on iron, starting with the practically pure iron, free from phosphorus, there should have been as many samples for testing as there were tests to be made. Each of these before being melted should have been properly mixed with the proportion of phosphorus desired, and each test carried out under the same conditions. It might be noted here that a metal was prepared for Mr. Keep's experiment which contained over 13 per cent of phosphorus, and was practically free from other elements; this was used in making the additions of phosphorus to iron. After tests of the effect of each of the elements separately on pure iron have been completed there should be tests of the effect of two elements in varying proportions, then of three, and so on. It will readily be seen that in order to make an exhaustive examination of the effect of the elements on cast iron there would be a very large number of tests required. * * *

The study of the effect of the elements upon steel with particular reference to steel rails has been very exhaustive, and, if our chemists and others interested in the iron business would take in hand the same work with reference to cast iron, they would unquestionably effect as great an advance in the knowledge of the proper uses of the metal as has been done in the case of steel.

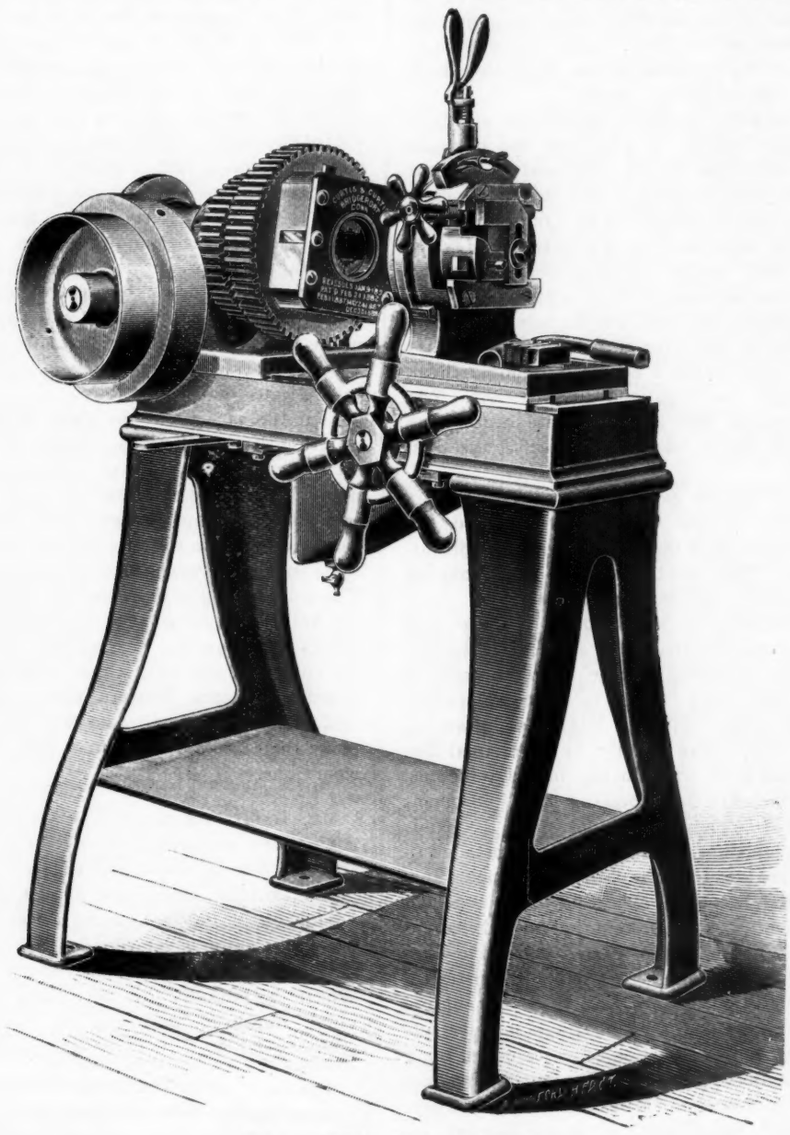
AMERICAN pig iron warrant stocks, March 31, 121,800 tons.

No. 20 POWER PIPE MACHINE.

The demand for a machine in which the pipe revolves and the dies are stationary, has led Curtis & Curtis, of Bridgeport, Conn., to design and place on the market the machine herewith illustrated. All its parts are made interchangeable so that any part can be duplicated by simply naming them. The gears are all cut from the solid block, and all working parts are finely finished to gauge.

To operate the machine, the pipe to be cut off or threaded is run through the hollow spindle of the machine from the left, passing through the self-centering guide chuck shown at the left of the spindle and the self-centering vise at the right, and the die-head. The pipe is then clamped by turning the screw in the vise, which not only clamps the pipe but brings it central with the dies; by turning the hand wheel shown on the front of the machine, the die-head is moved so that the cut-off tool comes opposite the point on the pipe where it is desired to cut, and can there be clamped in position. The back stop shown on the right side of the die-head is run down over the pipe, and the pipe cut off by turning the wheel on the side of the die-head. All this cut-off arrangement is self-contained and allows a movement within ways, so that if the pipe should be slightly bent or out of round it would move with it, and thus facilitate the operation. If it is then desired to thread this end of the pipe, the lever shown on top of the die-head is thrown over to the proper graduation on top of the machine, which brings the dies to the standard size for the size of pipe to be cut. Should there be found, as often occurs, that the fittings to be used varied from the standard, the proper allowance can be made with this lever so as to cut over or under standard size. Where a number of pieces of the same size are to be cut, as in making nipples, the block, into which the lever engages, can be set to size, and the lever simply snapped back into it each time without resetting. This feature is of particular value where the machine is operated in a dark room or where unskilled labor is employed. The die-carrying head is then advanced by turning the hand wheel shown on the front of the machine, operated through a rack and pinion under the die-head, and the dies lead on to the pipe.

When the dies have advanced as far as desired, the top lever is thrown back, which frees the dies from the pipe, the die-head is drawn back and the pipe is removed, without running back over the thread. The machine is arranged with two sets of gearing for rotating the spindle and pipe, each of which is adapted to give a different speed to the machine. A change of speed from one to the other is obtained by simply moving a convenient lever while the machine is running at full speed and without being obliged to stop. This feature will be found of great value, especially in changing from threading to cutting off, where a higher speed is desirable. Thus, with a change of belt speed on the cone, four speeds of machine are attained. When desired, the machine is fitted with a hand-wheel, which is attachable to the cone-shaft, thus allowing the machine to be operated by hand power. Solid pipe or bolt dies can be used with the machine when desired.



NO. 20 POWER PIPE MACHINE.

ACTIVE construction work on the Cleveland-Cliffs Iron Co.'s charcoal furnace at Gladstone, Mich., will begin within another week, and employment will be given to 300 men in the spring and summer months. The double trestle, 1,500 feet in length, on which the contractor will begin work at once, will require 500,000 feet of lumber.

LORAIN'S STEEL PLANT.

[Continued from Page 7.]

There are two ladle repair cranes and one spiegel ladle crane, all hydraulic. The two spiegel cupolas are 20′ high and 8′ diameter. There is also a ferro preheating cupola.

The power house, 222′x53′ contains at present, in addition to other equipment, the Straight Line engines furnishing power for the Johnson Electric Railway between Elyria and Lorain. The blowing engine was built by the Southwark Foundry & Machine Co., of Philadelphia. It has 36″ high-pressure and 72″ low-pressure cylinders, and 60″ stroke, the blowing tubs being 70″x60″. In the same building are a Davidson pump of 1,500,000 gallons capacity, a 1,000,000-gal. Worthington pump, two Barr pressure pumps 12″ water cylinder and 30″ stroke, an accumulator 30″x16″, and two Worthington boiler-feed pumps. Another accumulator of the same size as that in the power house, is installed in the converter house in connection with the hydraulic crane service there. A Buckeye engine in the power house drives the Siemens-Halske dynamos which furnish power for the various electric cranes.

The plant is equipped with two boiler houses, one of which is located near the power house. It is 75′x155′ and contains 3,000 h. p. National water tube boilers. The coal is brought into the building on a trestle running its full length opposite the boilers. It is dumped from the cars by the pulling of a lever and falls into bins from which it is elevated by Heyl & Patterson conveyors and carried to large bins above the boilers. It is fed to the furnaces through iron pipes. The Murphy automatic stoker is employed, and the attendance of a man and a boy answers for the entire equipment. The ashes drop to a pit below from which a conveyor removes them. Draft and water supply are regulated automatically. The boiler house for the shape mill is a duplicate of the one described above, except that it has larger capacity, the total being 3,300 h. p.

A plant of four Duff double gas producers is located in a building 75′x70′. These supply the pit furnaces and the heating furnaces connected with the shape mill. The pit furnace house is 80′x100′. There are two six-hole ingot soaking pit furnaces, commanded by two Morgan cranes.

The ingots are delivered by car to the table of the 38-inch blooming mill. The mill is driven by a 55″x60″ double-cylinder, high-pressure reversing engine from the works of the Galloways, Manchester, Eng. There is no compounding steam and no condensing. With an engine so powerful, coupled direct to the rolls, it can readily be understood that there will be some rapid work in reducing ingots to blooms. Another conspicuous factor in the blooming mill equipment is the 35-ton Yale & Towne crane, of 60-foot span. Its handling of the ponderous housings, as they have been installed in the mill, has given some idea of the rapidity with which transfers can be made when in actual operation. It is expected that not more than 40 minutes will be required for roll changes in the blooming mill. The number of passes required to work down the ingots to 6½″x8″ blooms is yet to be demonstrated, but it is safe to say that it will be less than 11. Crane engines operate the tables. Morgan hydraulic shears—a massive tool—will shear the blooms to weight. For billet purposes, Long & Allstatter steam shears are provided. The four-ton hammer in the blooming mill is of Bement, Miles & Co. make. Three five-ton hydraulic cranes, two of which are at the hammer, insure rapid work in handling. For the hydraulic service of the blooming mill there is a 15″ accumulator. When the mill is run on billets they will be carried to the yard by a Heyl & Patterson conveyor.

The shape mill, with its heating furnace building, roll-changing shop, hot saw building, hot bed building, straightening building and finishing building, has an outside measurement of 820′x440′. Provision is made for automatic conveyance of the blooms to the heating furnace building, and the furnaces are served by two cranes, one for charging and one for drawing. In the shape mill are two Galloways engines—a new one ordered with the large blooming mill engine, and another transferred from the Johnstown plant. The former is 48″x50″ and is employed to drive two trains of roughing rolls, and the latter, 45″x48″, drives two trains of finishing rolls. They are double-cylinder, high-pressure, condensing engines, a Davidson condenser being used with the larger and a Worthington condenser with the smaller engine. A 40-ton Morgan electric crane commands the roughing and finishing rolls and when changes are made housings and rolls will be lifted out of place together, and new rolls with their housings substituted. It is calculated that a roll change can be made in this manner in 20 minutes. Much of the rolling machinery was transferred to Lorain from Johnstown, but the switch plant is still maintained at the latter point. The rail-making capacity at Lorain is double that of the plant as it stood at Johnstown. Sixty-foot girder rails, a length not rolled elsewhere, can be produced at the new plant.

The roll machine shop, 400′x50′, is well equipped with tools, and its scores of rolls are well arranged for ready identification. A Morgan electric crane sweeps the building. Sturtevant hot blast is provided. Sturtevant blowers are found also in the power house, furnishing blast for the cupolas.

Situated somewhat apart from the shape mill, the splice bar shop, 50′x80′, completes the list of buildings.

Perfect as is the hydraulic equipment of the plant, the arrangements for water supply, to which nature has contributed not a little, are no less so. Through the shale a tunnel 4′ 6″x5′ 6″ was cut 2,000 feet from the steel plant to the reservoir at the river. All that was required to make this reservoir, which now has 44 feet of water in it, and a capacity for nearly 60,000,000 gallons, was to throw a dam across a ravine running down to the river. Forty-five feet below, on the bank of the river, is located the pumping station. Its two 3,000,000-gallon centrifugal pumps, furnished by the Southwark Foundry & Machine Co., are driven by General Electric Co. motors. The return water system takes the water back to the upper portion of the reservoir At the steel plant a complete conduit system has been constructed, containing pressure pipe, water pipe and return water pipe.

As to the capacity of the plant—actual operation is a better criterion than predictions. There will be no difficulty about attaining 1,000 tons a day of rails, shapes and billets, and this no doubt could be increased to 1,500 tons a day. It is hard to see how anything further could have been provided that would contribute to the economy and rapidity of the operations coming between the cupola house and the finishing mill. The modernizing of every feature of the equipment, added to the well-known advantages of the lake site, in assembling materials and in getting product into important markets, make the enterprise one from which more and more promises to be heard, in Central Western steel-making. It would appear that a low-price era will have few terrors for this Black River plant that has made its first cast under circumstances so auspicious.

MR. WILLIS SHAW, 416 New York Life Bldg., Chicago, has lately taken the selling agency for a number of well-known articles, among which are the following: Gardner steam pump, Coleman centrifugal pumps, Bacon hoisting engines, Speidel chain hoists, Lansing wheel barrows, Akron tubular barrows, Canton steel roofing, Norton jack screws, and the mining and contractor's cars and trucks made by the Russel Wheel & Foundry Co. Mr. Shaw reports that business is much improved, and that the number of inquiries he is receiving for the lines he sells is continually increasing.

AN article by Thos. D. West on "The Beneficial and Evil Effects of Sulphur in Cast Iron," will appear in the next issue of *The Iron Trade Review*. In it Mr. West defines and explains his statement in our issue of March 28, that "with proper conditions in melting, as a general thing sulphur is raised twice as much as silicon is lowered in remelting iron." In the article of last week, the insertion of lines 33 and 34 from the beginning is a typographical error. Both lines should have been omitted; they occur in their proper place later in the article.

THE Lloyd Booth Co., Youngstown, O., has received the contract from the Canton Rolling Mill Co., Canton, O., for a 22″ cold rolling mill, together with a large number of chilled rolls. The order is practical testimony to the excellence of the Youngstown company's product in view of the fact that it built the entire mill for the Canton company, and the long service of the rolls furnished warranted the rolling mill company in placing its contract again with these well-known builders of rolling mill equipment.

STEEL STRUCTURES AT MINES.*

BY HARRY J. LEWIS.

The very material reductions which have taken place in the price of structural steel work during the two years just past, place within easy reach of mine operators a type of outside rig which has heretofore been considered a luxury. Some of the first experiments in the use of steel structures have not been entirely satisfactory because the purchasers did not place the matter in competent hands and in consequence obtained in some cases a frame work which was ill-designed and entirely too light for the work it had to perform. In other cases they were loaded up with a lot of unnecessary material. The first case is by all means the poorest bargain of the two as the rig never gives satisfaction from the very first day it is put in service and its cost is very little less than that of a good rig. It takes practically the same number of columns, beams, bracing, roof trusses, etc., for a light structure as for a heavy one and a comparatively small amount of additional material enables the designer to obtain the benefit of much larger and much stiffer sections. It is an adage among engineers that a structure which is too heavy in all its parts never gives any trouble except through a slightly increased interest charge on plant and this is therefore not a serious fault if the extra material is kept within reasonable bounds.

The service strains developed in a head-frame or tipple frame are of such character as to render their exact determination difficult, arising as they do from a combination of static and dynamic loads. A good instance of this sort is where the throttle of a first motion hoisting engine is pulled wide open at the beginning of the lift, in which case the strain in the hoist rope while the load is being started is often more than twice the static weight of cage, mine car and load. This strain must be transferred from the head sheave through the different members of the head-frame to the foundation and the designer who fails to take account of this extra load will not get a stiff structure.

Another thing which should not be neglected is that the horizontal component of the strain in the portion of the hoist rope leading from the head sheave to the winding drum, various from its maximum to almost nothing every time a load is hoisted rapidly and dropped upon the cage keeps at the top. This strain also alternates from side to side of the head-frame with each lift and sets up a combination of racking and twisting strains which must be taken into account if a stiff and durable structure is desired. In attempting to provide for these strains, the writer has found it advisable to do away altogether with adjustable rods in the bracing and use stiff members throughout with solid riveted connections. This avoids entirely the necessity for continually screwing up sleeve nuts or turn buckles, and any engineer who has had experience in the adjustment of bridges will hail with delight any device which will relieve him from the horrors which may be perpetrated with a monkey-wrench in unskilled hands.

Some of the first steel head-frames turned out badly because the arrangement of the supports for the head sheave bearings were copied from the older wooden type in which the tops of the columns were subjected to transverse strains in addition to their legitimate work. In consequence of this the columns' heads deflected every time a lift was made and threw the bearings out of level, thereby causing them to cut and give trouble generally. In endeavoring to correct this feature, the writer has devised an entirely different arrangement of head sheave supports in which each member has its own legitimate work to perform and is proportioned for the load transmitted as nearly as this can be determined.

A word as to the proper inclination of the hoist rope between the head sheave and winding drum may not be out of place, as in case the angle is too steep there is a considerable force acting to lift the winding engine vertically off its bed, and if too flat the racking tendency on the head-frame is equally destructive. The best results appear to be obtained by using inclinations varying between 35 and 50 degrees with the horizon.

In taking up the problem of strains in the tipple frame we find that in this also the horizontal strains need to be provided against very carefully. These arise from suddenly stopping on the tipple horns a load of from two to four tons moving at a speed of one to five feet per second. Probably the best plan for handling this is to provide a heavy floor on the level of the dumps and firmly attached to them, the proportionate y greater mass of which first receives the shock and lengthens the period of time of transference into the frame work and thence to the foundations. In order to provide space for the passage of cars under the tipple, the columns must be left unsupported in the direction of the greatest strain for a height of eight to ten feet from the bottom. They are therefore subjected to transverse strains and must be proportioned accordingly. The writer is free to admit that this is largely a matter of judgment and the proper proportions can only be arrived at by experience. This difficulty can be obviated in some cases by attaching the tipple to the head frame, which latter should always possess a complete system of longitudinal bracing clear to the bottom. In some other cases a panel containing complete bracing can be placed in the rear of the span over the tracks but for the most part this latter plan is more expensive than to enlarge the main columns and beams.

Simplicity of design both in main members and connections should always be aimed at in a tipple frame, so as to render easy any changes in screen rig which the varying demands of the trade may require. The tipple house should consist of a steel frame work and covering throughout, no wood being allowed except in doors, windows, partitions and floors. Wood should never be used in such a manner that the stability of the structure would be impaired by burning it away entirely. Absolutely fire proof construction is not an economical possibility at present but the danger from fire can be greatly reduced by proper designing.

The roof and siding should be of heavy corrugated iron, riveted fast by means of metal clips to steel purlins and side girts. It is the poorest sort of economy to use a light weight sheet in the covering and the writer would recommend that nothing lighter should ever be used than No. 20 for siding and No. 18 for roofing. For structures intended to last in one place for 20 or 30 years heavier sheets than the above can be used to advantage, as the extra expense is mainly in the added weight of material.

Another thing which should be looked out for where possible is the introduction of a fire-insulating space between tipple and head frame, tipple and shaft opening or tipple and slope mouth. This space should be at least 10 or 15 feet wide, and across it no continuous line of inflammable material should be allowed to exist; not even those two streaks of oil which seem to follow wherever a mine rail is laid.

The use of screens, chutes, hoppers and pans made entirely of metal has become so nearly universal that it is hardly necessary to say anything in their favor. Some makers of this class of equipment have in their efforts to cheapen it, used material which was altogether too light and scattered their rivets so far apart that they were hardly on speaking terms with each other. This policy is certain to result in a rig which is a rattle trap at first and a wreck before it has had a chance to get old. The dump plate at the head of the screen should be from $\frac{5}{16}$″ to $\frac{3}{8}$″ thick, so as not to be dented by the fall of the coal. All other bottom plates over which the main body of the coal runs should be from $\frac{1}{4}$″ to $\frac{5}{16}$″ thick. The sides of main screens and chutes may be from $\frac{1}{16}$″ to $\frac{1}{8}$″ thinner than the bottoms, as they do not receive the scour of the coal to the same extent. The bottoms and sides should be joined by angles with a thickness equal to the thickest plate, and with flanges wide enough to take $\frac{1}{2}$″ or $\frac{5}{8}$″ rivets driven hot. Where necessary, the top edges should be stiffened by similar angles.

The pitch of rivets should not be ordinarily more than six inches and in very thin plates less than this. For the nut and slack chutes $\frac{3}{16}$″ and $\frac{1}{8}$″ plate may be used, as these handle only a small percentage of the coal and are therefore less subject to wear.

There are but few cases where the engineer in charge of a new opening will find it difficult to provide plenty of height from dump to railroad tracks, and it is to be regretted that so many mistakes are made on this point. This height depends on the number and kind of separations that are to be made and the screen plan should be carefully worked out before the general plan of opening is finally decided on. A failure

*From a paper on "Steel Mine Rig" read at the 1895 meeting of the Ohio Mining Institute at Columbus, O.

to do this has often resulted in a fixed charge for elevating etc., which in view of the narrow profits of mining should always be avoided where possible. For a modern rig making three separations, viz: lump, nut and slack, it is safe to assume that this height should never be less than 30 feet.

Many of the older rigs having a height of 26 and 28 feet, and which were all right in their day, are now giving a great deal of trouble because their discharge chutes will hardly clear the tops of the new gondolas, and trimming the coal to a neat ridge is not to be thought of.

Great latitude is required of a rig which is to load neatly and with minimum breakage, all cars which may come to it at the present time. A table of extremes in dimensions of cars is approximately as follows: Floor to rail, 3′ 8″ to 4′ 3″; top to rail, 6′ 6″ to 8′ 6″; extreme width 9′ 3″ to 10′ 6″; length over all, 20′ 0″ to 36′ 0″. Sorting these cars so as to give an hour's run on a similar kind is not to be thought of and the rig must pounce on high and low alike without so much as letting out a rod or taking up a chain.

It is not an easy matter to give an idea of the cost of metal as compared with wood for the reason that when the purchaser has made up his mind to use metal he demands a better rig in every way than he could possibly get in wood. Taking this into account, the advance over the price of wood will probably average 50 per cent.

Among the advantages which a properly designed metal rig has over a wooden one are these: Comparative safety from fire. The bill for pumping alone in some mines while replacing a burned out tipple would more than pay the difference to say nothing of other losses. Durability. A metal rig which is heavy enough for its work is much more durable on account of its greater elasticity which enables it to sustain shocks without permanent deformation. In consequence of the above a good metal rig should last 20 or 30 years even if taken down and put up in different locations, while a wooden rig which has seen six or seven years' service is not worth taking down, much less putting up again.

In conclusion it may be said that as the tipple is the focus toward which all the other operations of the mine are directed and through which all the product must pass, the progressive operator will see to it that it is of the best and most durable both as to material and design.

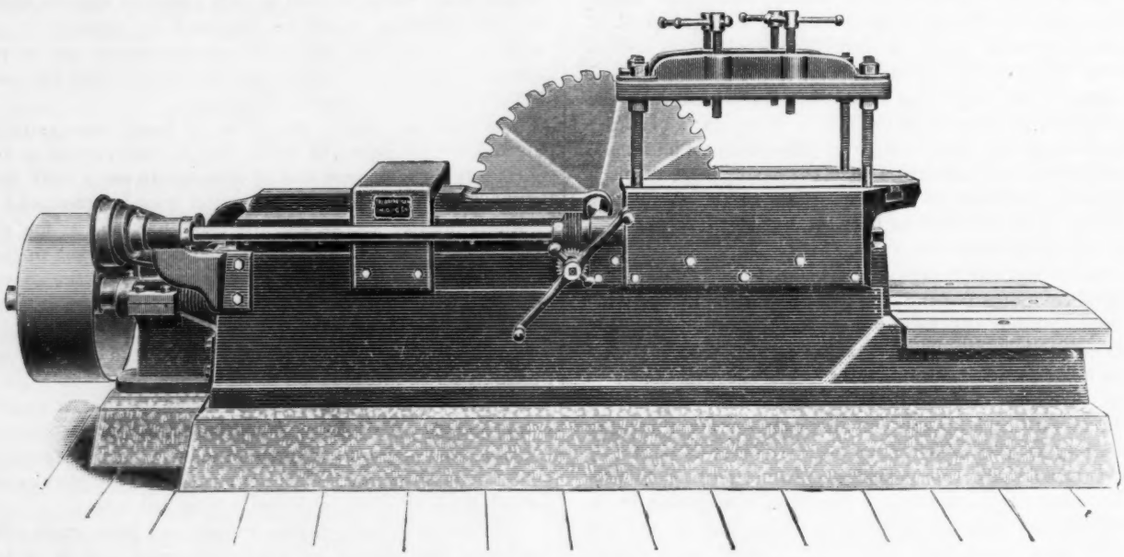
Johnson Rails to the East via Canal.

The Steel Canal Barge Co., recently incorporated, with headquarters in Cleveland, placed an order last week with the Globe Iron Works Co., of Cleveland, for a fleet of six boats—a steamer and five consorts, each 98 feet over all by 17 feet 9 inches beam and 10 feet depth of hold. The boats will carry bulk and package freight by water from Lake Erie ports to New York and New England, by way of the Erie Canal. On the day the contract was let for these boats, the barge company contracted with the Johnson Co. to carry 10,000 tons of rails to New York.

THE BRYANT METAL SAWING MACHINE NO. XX.

This machine has been reconstructed and improved, and is now recognized as one of the most substantial and valuable cold saws in the market. Special stress is laid by the makers on its great capacity. It is designed to belt direct from the main shaft, no counter shaft being necessary. It can be equipped with a small engine on carriage if desired. It is furnished with an automatic feed of three different speeds, enabling the operator to change the cutting speed at will, to accommodate light or heavy work. It is especially adapted to all classes of architectural work, cutting beams, channels, girders, etc., either square or miter, making a perfect joint. It is also used extensively in frog and switch works, rolling mill forge works—wherever cold sawing is necessary.

This machine has a capacity of 36x12 inches. It will also cut any angle, the special clamping device being arranged to hold work in any way. It will make a miter cut up to 24 inches, and this can take in large architectural work, forgings, rolls, etc. It is substantially constructed, and is furnished with a false table for extra large work; for rail sawing, several can be placed on the machine at once, making a saving of time. It has automatic chain feed, fast and slow, which can be instantly changed by the operator. It also has tight and loose pulleys for five-inch belt, and is designed to run direct from the main shaft. Each machine is furnished with two 30-inch saw blades, and special grinding machine. Power required from two to four horse; floor space, 2½x12 feet. Further particulars and details will be sent upon application to the manufacturers, the Q. & C. Co., 703-706 Western Union Bldg., Chicago.



THE BRYANT METAL SAWING MACHINE NO. XX.

Welded Rail Joints.

Welded rail joints, both by the electric process and cast, have stood the crucial test of an exceptionally severe winter and have weathered the storm with a record even better than was expected by the most sanguine. "So successful has been the test," says the *Street Railway Review*, "that we feel warranted in pronouncing the practice an accomplished success. In one of the earlier editions of Trautwine the statement was made that joint space between rail ends was not necessary to allow for contraction and expansion. This was eliminated in succeeding editions. For many years the best engineers have religiously stood by the expansion theory and looked on a dissenter as a rank heretic. It is true that with the usual space left at joints longitudinal expansion occurred. Naturally the movement of molecules was in the direction of least resistance. When there is no space left into which to move, the particles adjust themselves to the new conditions and either compression of particles occurs or expansion is had vertically and longitudinally, probably both, but without bulging or bending of the rail itself. The endless rail has been a long time coming but it is here now."

ANOTHER Youngstown finishers' lodge has disbanded.

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SWISS MARKET FOR AMERICAN TOOLS.

While it is true that the discoveries often made by the Government's consular representatives abroad come long after the initiative in a particular line of trade has been taken by manufacturers on this side, the consular letters are not without their value in giving publicity to what is going on in export extensions. We print the following report of Eugene Germain, U. S. Consul at Zurich, not so much for any new information it contains, as for the emphasis that needs to be given all the time to the need of proper preliminary work, if American machinery manufacturers are to get any permanent or remunerative trade from European markets:

"American wood-working machinery and tools can, I think, be introduced into Switzerland. Furniture, wagon, and carriage manufacturers are still using old methods to cut, carve, or bend what wood they work up for their requirements. If a good, expert agent, able to speak French and German, were sent out to visit the different manufactories and shops of the country, he could, I am sure, secure large orders. Care should be taken, however, to have all such machinery and tools patented in Switzerland, as well as in Germany, to prevent imitations being manufactured from the first models sent out, for it is a well-known fact that German manufacturers make it a practice to imitate our machines and tools and then cut under our prices.

"Mr. J. Geissberger, a carriage manufacturer of this city, desirous of enlarging his plant, requested me to supply him with the addresses of American wood-working machinery factories. I gave him such addresses as I could obtain. He corresponded with several firms, obtained catalogues and price lists, and he now informs me that he is getting ready to order about 25,000 francs' ($5,000) worth of machinery from one of two firms in Ohio. He has written for further particulars, requesting, among other things, plans and specifications as to how to set up and place such machinery to advantage, after the receipt of which, he says, he will no doubt order.

"A wagon manufacturer of Burlington, Ia., visited this city last summer, and on his rounds dropped into Mr. Geissberger's shops. He succeeded in selling him about $100 worth of wagon and carriage wheels to be shipped upon his return home. Mr. Geissberger received this trial shipment lately, and is highly pleased with the goods as to workmanship, quality, and price, the cost laid down here being much less than Mr. Geissberger could manufacture them himself. It must be remembered that, if shipped in large quantities, much lower freight rates could be obtained, and goods could be laid down at a lower figure than this first trial shipment has cost.

"I merely mention this transaction to demonstrate that wood-working, time-saving machinery, in the manufacture of which the United States excel all other nations, will be wanted in Switzerland as soon as people are educated to its use, for they much prefer to manufacture there own wheels, furniture, etc, than to import these articles ready made, if by securing and working the proper machinery, they can, with cheaper labor and longer hours than we have, manufacture for themselves and save money. Now, Mr. Geissberger is but one in a country with 3,500,000 people, among whom are many manufacturers who would gladly avail themselves of time saving machinery, if they only knew where to get it and how to work it. I have an idea that our wood-working machinery manufacturers would not only find a good field to operate in here, but also that Germany, England, France, Austria-Hungary, and Italy would also be good ground to canvass."

Iron Mill Scale Remains Unchanged.

A scale conference between valley iron manufacturers and the officers of the Amalgamated Association was held at Youngstown, O., Saturday, March 30. Beside those from Mahoning and Shenango valley mills there were representatives present of important producers in the Cleveland and Ohio River districts. The result of a meeting lasting to a late hour in the night was the decision of the manufacturers to withdraw the request for a reduction of puddling to $3.50, with 15 per cent. reduction in finishers' wages. The negative vote of the various lodges was reported by the Amalgamated Association officers, and the inability of the puddlers to make a living under the proposed rate. The signs of improvement in demand, which had increased since the 60 days' notice to terminate the scale had been given, were also emphasized by the men. The meeting was quite harmonious and the situation was thoroughly canvassed. One clause in the scale agreement relating to special products was changed as asked by the manufacturers. Otherwise the same rates will prevail as heretofore and the scale will be continuous, either side having the right to terminate it on 60 days' notice.

THE Kurtz & Buhrer Foundry Co., with office at 4 Canal st., and works at 832-840 Austin ave., Chicago, reports a largely increased business in the past few weeks. The last of February its foundry was taking off three and four heats a week; now the rate is a heat every day, and the heats are considerably larger. This concern makes a specialty of high grade iron castings, and with its complete and well equipped plant, is in excellent position to do justice to its patrons.

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INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

The Island Machine Co. has been formed at Skowhegan, Me.

Yonker & Winchester will embark in the foundry business at Eldora, Iowa, and will erect a foundry.

The W. H. Blake Steam Pump Co. has been organized at Fitchburg, Mass., with a capital stock of $20,000.

The Union Foundry & Machine Co., of Birmingham, Ala., has been incorporated with $5,000 capital stock.

R. C. Reinewald, 353 Calhoun St., Ft. Wayne, Ind., will buy a second-hand gas or gasoline engine, from one to four horse power.

The Queen City Foundry Co. has been incorporated at Denver, Col., with a capital stock of $20,000, by E. S. Irish and others.

The Northern Extract Co., Alpena, Mich., wants to purchase an engine lathe, either new or second-hand, about 20″x8′, with chuck, etc.

Geo. F. Winter & Co., New York Life Bldg., Kansas City, Kan., will receive bids for the construction of an iron viaduct at a cost of about $35,000.

The Fuller Engineering Co., of Calvert, Tex., has obtained control of the plant of the Calvert Foundry & Mfg. Co., and has organized to do engineering foundry and machine shop work.

The Southern Railway Co. will equip its new machine shop, smith shop, erecting shop, paint shop and store house at Nashville, Tenn., with the latest machinery for car and engine repairing.

John W. D. Maier, John N. Vieweg, Jos. W. Hazell and others have incorporated the Courtland Machine Co., at Baltimore, Md., with a capital stock of $10,000, for the manufacture of machinery.

New Construction:—

The Carton Furnace Co., Utica, N. Y., has completed a new foundry building costing $10,000.

It is reported that the Cherry Valley Furnace at Leetonia, O., will be rebuilt the coming summer and its capacity largely increased.

The Wabash is to rebuild its roundhouse near Toledo, burned a short time ago. The new building will be of steel and fire-proof, with stalls for 12 engines.

The Pennsylvania, Big Four and other roads entering Columbus, O., have agreed upon plans for the proposed union station at that point. It will be 850 feet long and will be built west of the present building, which will be used for a train shed.

The National Foundry & Machine Co., Louisville, Ky., will build a machine shop, foundry and blacksmith shop. The building is to have composition roof, galvanized iron skylights, iron beams and columns, belting, iron working machinery, etc.

Additions, Enlargements, Removals, Etc.:—

Downing Bros., of Rock Island, Ill., have made arrangements to remodel their foundry.

An addition 40x50 feet is being built to the Washington Carbon Iron Works, at Washington.

The McKeesport (Pa.) Supply Co. will build a large addition to its plant, with a modern foundry equipment.

The York (Pa.) Mfg. Co. has decided to increase its capital stock to $400,000 and to erect a new and larger plant.

A new galvanizing mill is to be erected as an addition to the Consolidated Steel & Wire Co.'s works at Rankin, Pa.

Improved machine tools have been purchased and other improvements made by the Defiance (O.) Machine Works.

The Fitchburg Railroad Co. has decided to double the capacity of its repair shops in Keene, N. H., and the work of enlargement will soon begin.

Extensive improvements are being made in the equipment of the rolling mill at Laramie, Wyo. Among other things the manufacture of railroad links and pins will be added.

The Sessions Foundry Co., of Bristol, Conn., expects to build a large complete works for the manufacture of gray iron castings. The main foundry building is to be 500x110 feet, shipping building 300x70 feet, pattern shop 60x80 feet, two stories; pattern storage building 50x100 feet, two stories, a large power house and an office. The main buildings are to be built with steel trusses and plank roofing, covered with slate.

Fires and Accidents:—

The molding room of the foundry and machine shops of Hedgewald & Co., New Albany, Ind., was damaged to the extent of $25,000 by fire March 28. Insurance, $8,500.

General Industrial Notes:—

Hannah Furnace of the Mahoning Valley Iron Co., Youngstown, O., went in blast March 31 and will make Bessemer pig.

It is reported that the Lindsay & McCutcheon puddling

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5-lb. Can	$ 1.50
10-lb. Can	2.90
25-lb. Can	6.75
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furnaces in Allegheny are to be torn out and a sheet mill substituted.

The skelp mill of the Lebanon Rolling Mill, at Lebanon, Pa., has closed down.

The Alabama Pipe Co., of Bessemer, Ala., will probably put its plant in operation in a few weeks.

The puddlers of the Central Iron Works, Harrisburg, returned to work at the old rate of $2.75.

The Columbia Rolling Mills of Middletown, Pa., have started up in all departments—nine furnaces, the bar and guide mills.

The merchant mills of Steelton, Pa., have resumed work. All the departments of the steel works, except the billet mill, are in operation.

At Washington, Robert Leitch & Sons, brass founders, made an assignment to J. W. Somerville. The assets amount to $102,431 and liabilities to $65,451.

The Brown, Bonnell Iron Co., Youngstown, O., successfully turned out from No. 3 bar mill in one day last week 50 pieces, each 66 feet long, of 6x6 angle bridge iron.

The Cambria Iron Co., Johnstown, Pa., has arranged to convey hot metal direct from its furnaces to its Bessemer plant and will employ that arrangement for the most part.

The Thomas furnaces, near Birmingham, Ala., which have been idle for nearly a year, will start up in a few weeks. For some time these furnaces have been undergoing repairs.

The board of appeals of McKeesport, Pa., has reduced the valuation of the property of the National Tube Works Co. from $1,400,000 to $1,250,000. The last valuation was $1,100,000.

The directors of the Daniels Steel Tie Co., Youngstown, O., elected the following officers for the ensuing year: Thomp Burton, president and general manager; Lemuel C. Ohl, vice president; Clate A. Smith, secretary.

The Wheeling Steel & Iron Co. will put another blast furnace on in a few days, this move being made necessary by the inability of the three furnaces now in operation to keep the steel works supplied with Bessemer pig.

A Findlay, O., dispatch of April 1 says the Findlay Rolling Mill Co.'s plant there was closed on Monday on an attachment suit brought by the National Bank of Commerce, of Cleveland, and that the bank has $40,000 past due paper of the company. The plant has employed 300 men.

All records in the production of Bessemer steel at the Homestead Steel Works were broken March 28. The day turn in the converting mill turned out 76 heats, the greatest number in the history of the plant. The 76 heats aggregated a little over 800 tons. The night turn previously ran 72 heats.

At Milwaukee, two suits were begun last week in U. S. court by the Johnson Co., of Johnstown, Pa., against Alexander S. Lynn, superintendent of construction of the Milwaukee Street Railway Co., who, it is charged, is manufacturing and using a railway and a tongue switch, the rights to which are vested in the plaintiff.

The Struthers, O., sheet mill, formerly operated by Summers Bros. & Co. was purchased March 30, by John Warner, of Niles, O., who has been connected for a number of years with the Falcon Iron & Nail Co., of Niles, O. It is given out that Mr. Warner intends building a new sheet mill and spending $20,000 in this and other improvements before a start is made.

The Lodge & Davis Machine Tool Co., of Cincinnati, O., has opened a branch store in St. Louis at 720 N. Second st., where a large stock will be carried of lathes, planers, milling machines and other standard tools. Mr. J. W. Wright, for many years connected with the works at Cincinnati, and later with the Chicago branch, will manage the St. Louis business.

The North American Metaline Co., of 40 48 Third st., Long Island City, N. Y., received the following letter under date of Feb. 21, from Geo. S. Rider, Mechanical Department, University School Cleveland, O.: "Will you kindly furnish us with one set flanged bushings for loose pulley. * * The [oilless] bushings furnished by you last September have given such good satisfaction that it is a pleasure to remember them."

The receivership of the Walter A. Wood Harvester Co., at St. Paul, was followed by a receivership in Indiana. At Indianapolis, F. A. Seymour, A. H. Lindeke and P. S. McGowan of St. Paul, were appointed receivers of the Indiana property of the company. It was claimed that the National Bank of the Republic at Indianapolis had collateral paper amounting to $62,000 which it intended selling to satisfy $25,000, and the step was taken as protection.

At Akron, O., March 28, the Akron Iron Co.'s plant was sold to S. L. Severance, president of the Euclid Avenue National Bank, of Cleveland, who represented a majority of creditors. The price paid was $200,300, two-thirds of the appraised value. A new company will be organized at once. The plant has been in the hands of Receiver J. A. Long since December, 1893. It is understood that the purchasers of the plant will issue bonds to pay off amounts due smaller creditors.

Supt. Thomas Morrison, of the Edgar Thomson Steel Works, Braddock, has commenced a sweeping reduction of his present force. Yesterday six draughtsmen, six inside carpenters, ten machinists, ten pattern makers and the entire painting force were laid off. The laboratories at the blast furnaces and steel works will be consolidated, and ten chemists and half the present force discharged. All the working bosses in various departments have been laid off. Other changes will take place.—[Pittsburg Times, 28th.

Car building: The Bloomsburg Car & Mfg. Co. has a large order from Mexico for platform cars. Contracts

were let last week for 1,000 coal cars for Pennsylvania lines west of Pittsburg. Delaware & Hudson Canal Co. has ordered 150 box cars from the Jackson & Woodin Car Co., of Berwick, Pa. The Union Tank Line has placed an order for 50 tank line cars to be built at its Buffalo shops. The Missouri, Kansas & Texas order for 2,000 freight cars is still delayed pending some tests of material to be used in their construction.

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Whether the tourist's fancy directs him to the New England States or the Atlantic seaboard; to the South; or to the lake region of the North; or to the Rocky Mountains and the wonderland beyond the Mississippi, he will be given opportunity to indulge his tastes at a small cost for railroad fare this year. There will be low rates to Baltimore over the Pennsylvania Lines in May, account the American Medical Association; to Decatur, Ill., account the German Baptist (Dunkard) meeting, and to Pittsburg for the Presbyterian General Assembly. There will also be low rates over these lines to Meridian, Miss., account the General Assembly Cumberland Presbyterian Church the same month. In June, excursion tickets will be sold over the Pennsylvania Lines to Omaha account the National Jr. O. U. A. M.; to Chattanooga, Tenn., for the International Convention of Epworth League; to Cleveland, Ohio, account the National Republican League Meeting, and to Roanoke, Va., for the German Baptist meeting. Excursions for July include low rates over the Pennsylvania to Baltimore for the Baptist Y. P. Union Meeting; to Asbury Park for the L. A. W. Meeting, and to Boston for the Christian Endeavor Convention, and to Denver, Col., account the National Educational Association meeting. In August, excursion tickets will be on sale over the Pennsylvania Lines to Boston, account the Knights Templar Conclave. The sale of low rate tickets will not be restricted to members of the organizations mentioned, but the public generally may take advantage of them.

In addition to the above, there will be plenty of other cheap excursions over the Pennsylvania Lines to various points. As the season is some weeks away, arrangements in detail have not been consummated, but it is certain that no railway will offer better inducements than the liberal concessions in rates and privileges that may be enjoyed by travelers over the Pennsylvania Lines. This fact may readily be ascertained upon application to any passenger or ticket agent of these lines, or by addressing F. Van Dusen, Chief Assistant General Passenger Agent, Pittsburg, Pa.

THE most notable article in the *Century* for April is the account of the "oscillator" and other inventions of Nikola Tesla, in which Thomas C. Martin, editor of the *Electrical Engineer*, makes the first full and authoritative announcement of several recent electrical inventions of Tesla. The oscillator, the new machine for the production of power, combining the steam engine and dynamo, is fully described both in its single and double forms, and a plan and a picture of the machine are presented. Other experiments described in the article relate to Tesla's system of high-frequency electrical currents as applied to the production of light, and especially to the production of light by induction. The first announcement is also made of Tesla's success in disturbing and demonstrating the earth's electrical charge, which is illustrated by pictures of the Tesla coil, and which points in the direction of telegraphy without wires. Among the illustrations are several portraits of well known men taken in the inventor's workshop, including the first photographs ever taken by phosphorescent light, showing the face of the inventor and that of Mark Twain, and also portraits of the humorist, and of Marion Crawford and Joseph Jefferson, all in illustration of certain electrical phenomena.

Home-Seekers Excursions South and Southeast via Pennsylvania Lines.

Special low rate excursion tickets with twenty day return limit will be sold March 5th, April 2d and 30th, from ticket stations on the Pennsylvania Lines to points in Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee and Virginia. For details, apply to nearest Pennsylvania Line Ticket Agent, or address F. Van Dusen, Chief Assistant General Passenger Agent.

SOME interesting experiments have for some time past been in course of prosecution at the Acieries de France at Isbergues, with a view to producing soft and very soft steel in the Bessemer acid converter by the silicon superheating process introduced by Messrs. B. Walrand and Legenisel. From the results obtained it is hoped shortly to be possible to produce in the converter in place of the ordinary Bessemer steel, an extra soft metal hitherto capable of production in the basic converter only.

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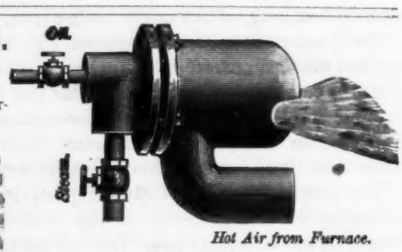

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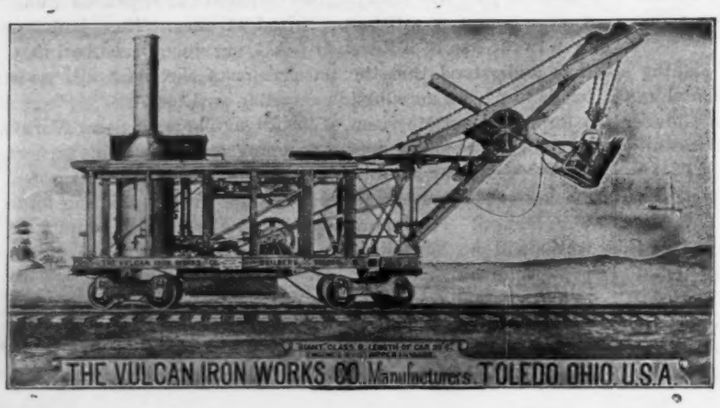

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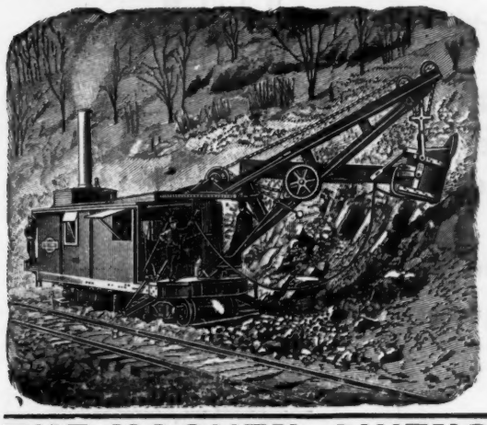

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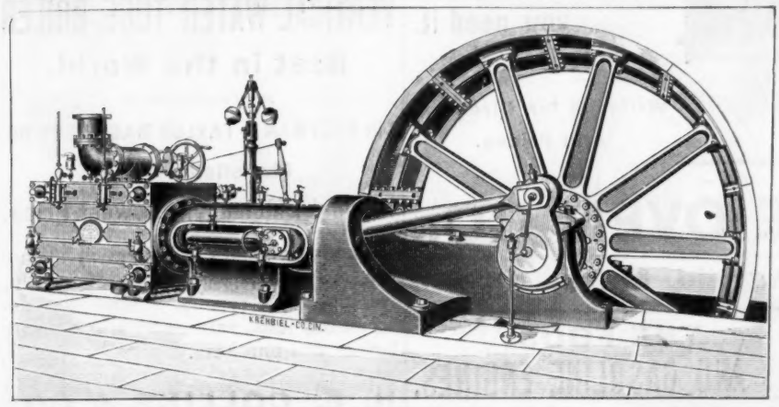

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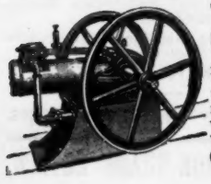

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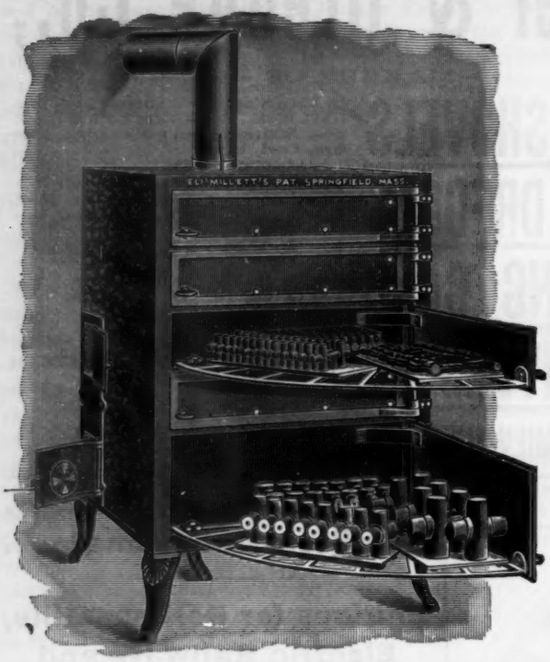

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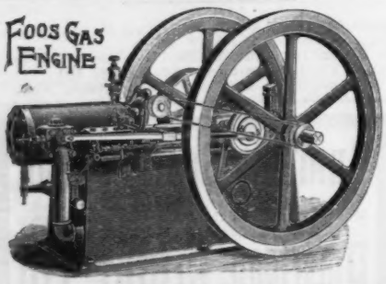

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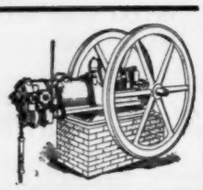

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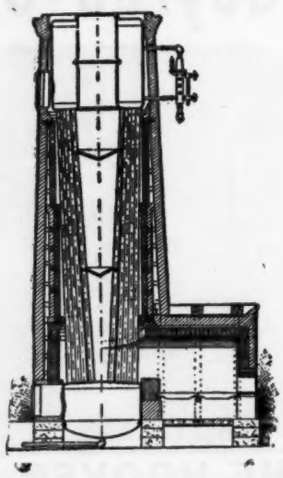

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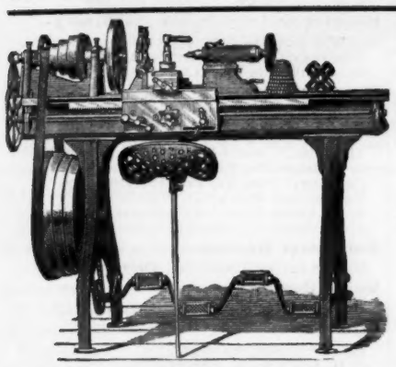

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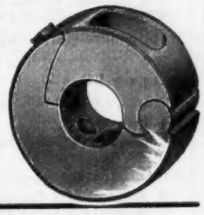

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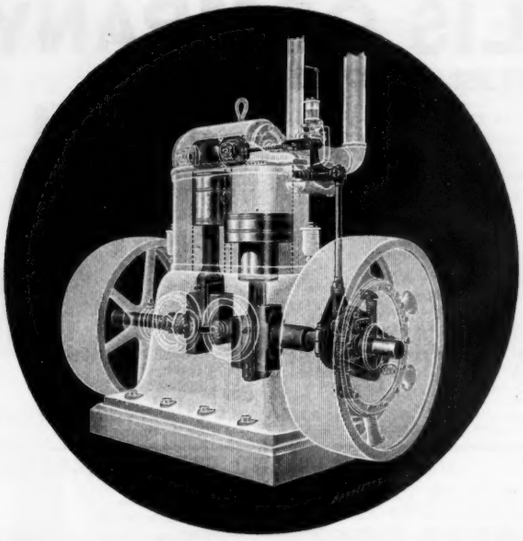

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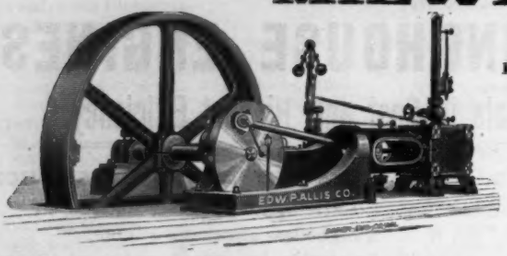

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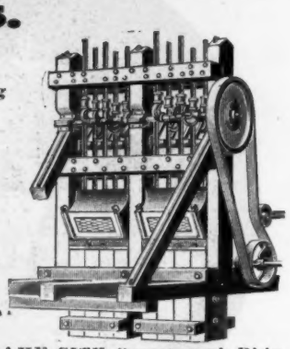

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Dixon, Jos. Crucible Co	23
Dover Fire Brick Co	2
Eclipse Electrotype & Engraving Co	17
Emmerton, F. A	2
*Empire Paint & Roofing Co	—
Enterprise Boiler Co	28
Fleharty, J. H. & Co	22
†Foos Gas Engine Co	18
Forster, Hawes & Co	1
Fox Machine Co	1
Fraser, John	13
*Freeman & Sons, S	—
Gerlach, Peter & Co	25
Gouverneur Machine Co	19
Gummey, Spering & Co	17
Harrington & King Perforating Co	26
Hartford Steam Boiler Insp. & Ins. Co	2
*Hendrick Mfg. Co., Ltd	25
Hill, Clarke Co	19
*Hodell, H. H. & Co	—
Hooven, Owens & Rentschler Co	17
Hunt Co., C. W	24
Illinois Central R. R	17
Illinois Screw Co	1
Iron Clad Paint Co	23
Jeffrey Mfg. Co	27
Jessop & Sons, Ltd., Wm	19
Jones Foundry Co., W. A	1
Jopling & Escobar	28
Keasbey & Mattison Co	2
Kurtz & Buhrer Foundry Co	19
Lane & Bodley Co	24
Lloyd Booth Co	26
*Lodge & Shipley	—
Long & Allstatter Co	23
Magnolia Anti-Friction Metal Co	1
†Mallett D. T	22
Manufacturers' Tool Supply Co	19
*Millett Core Oven Co	18
Milton Mfg. Co	28
Milwaukee Foundry Supply Co	13
Mitts & Merrill	28
Moore Mfg. & Foundry Co	18
Newell Bros	1
New York Machinery Depot	19
North American Metaline Co	25
Oak Hill Fire Brick & Coal Co	24
Oglebay, Norton & Co	25
Ohio Sand Co	28
Otto Gas Engine Co	18
Parker, Richard A	27
Pen Argyl Iron Works	27
Pittman, C. K	2
Pollock, Wm. B. & Co	2
Pope, E. C	25
Prentiss Tool & Supply Co	19
Q. & C. Co	28
Reese, Hammond & Co	28
Rhoads & Sons	15
‖Sharon Fire Brick Works	—
Sharpless & Winchell	21
Shaw, Willis	16
Shiffler Bridge Co	25
†Springfield Cupola Co	—
Stevens, F. B	28
Stilwell-Bierce & Smith-Vaile Co	2
Stowe, Fuller & Co	14
Sturtevant Co., B, F	2
Swarts Metal Co	1
Sykes Iron Roofing Co	18
†Tabor Mfg. Co	—
Tanite Co	28
Taylor & Boggis Foundry Co	1
Thurman Fuel Oil Burner Co	16
Timolat, J. G	19
Tod, Wm. & Co	26
Toledo Machine & Tool Co	27
Totten & Hogg I. & S. F'dry Co	24
Union Mining Co	14
†United States Graphite Co	—
United States Heater Co	28
Upson Nut Co	22
Vulcan Iron Works	16
Warren, Webster & Co	27
Wertheim, Ed	1
Westinghouse Machine Co	21
Westmoreland Fire Brick Co	23
Wheeler Boiler Co	26

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Checks, Letters, Invoices, Statements, etc.

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All the Months, Years from 1894 to 1899, Figures 0 to 99, "Rec'd," "Ans'd," "Paid," "Ac'p'd," "Ent'd."

Will never get out of order.

Price 50 Cents. SIZE OF TYPE DEC 25 1899

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THE UPSON NUT CO., Manufacturers of Nuts, Washers, Carriage, Machine, Plow, and Elevator Bolts, Coach Screws, etc.

Steel Stamps and Stencils.

FLEHARTY, J. H. & Co., Rubber Stamps, Seals, Stencils, Automatic Check Punches and Numbering Machines. 92 Seneca St.

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[On Lake Erie docks.]

No. 1 Specular, Bessemer	3.00@ 3.35
No. 1 Bessemer hematite	2.75@ 3.00
Hematites No. 1 non-Bessemer	2.00@ 2.50
No 1. Specular, non-Bessemer	2.35@ 3.00

PIG IRON.

CLEVELAND (f. o. b. cars):

Bessemer	$10 25@$10 50
No. 1 Strong Foundry	10 75@ 11 00
No. 2 Strong Foundry	9 75@ 10 00
No. 1 Gray Forge, red short	9 10@ 9 25
No. 2 Gray Forge, neutral	9 00@ 00 00
No. 1 American Scotch	11 00@ 00 00
No. 2 American Scotch	10 00@ 00 00
Lake Superior Charcoal	13 00@ 13 50

PITTSBURG:

No. 1 Foundry	$11 25@$11 75
No. 2 Foundry	10 25@ 10 75
Gray Forge	9 10@ 9 25
White and Mottled	9 00@ 0 00
Warm Blast Charcoal	17 00@ 18 00
Cold Blast Charcoal	22 00@ 26 00
Bessemer	10 25@ 10 40

CHICAGO (reported by our representative:)

Lake Superior Charcoal	$13 00@$13 50
Local Coke Foundry No. 1	10 25@ 10 50
Local Coke Foundry No. 2	9 75@ 10 00
Local Coke Foundry No. 3	9 40@ 9 65
Local Scotch Foundry No. 1	10 25@ 10 50
Local Scotch Foundry No. 2	9 75@ 10 00
Local Scotch Foundry No. 3	9 50@ 9 75
Southern Coke No. 1	11 00@ 11 25
Southern Coke No. 2	10 00@ 10 25
Southern Coke No. 3	9 50@ 9 75
Southern No. 1 Soft	10 00@ 10 25
Southern No. 2 Soft	9 75@ 10 00
Southern Silveries No. 1	11 50@ 11 75
Southern Silveries No. 2	11 25@ 11 50
Jackson Co. Silveries	15 00@ 16 00
Ohio Silveries No. 1	14 00@ 14 50
Ohio Silveries No. 2	13 00@ 13 50
Ohio Strong Softeners	12 50@ 13 00
Alabama Car Wheel	17 50@ 18 00
Malleable Bessemer	11 00@ 11 50
Coke Bessemer	11 00@ 11 50

CINCINNATI (reported by Rogers, Brown & Co.)

Southern Coke No. 1, Foundry	$ 9 50@$10 00
Southern Coke No. 2 and No. 1 Soft	9 00@ 9 25
Hanging Rock Coke, No 1	11 50@ 12 00
Hanging Rock Charcoal No. 1, Fdy	15 00@ 16 50
Tennessee Charcoal No 1	13 00@ 14 00
Jackson County Stone Coal No 1	14 00@ 14 50
Southern Coke, Gray Forge	8 25@ 8 50
" " Mottled	8 00@ 8 25
Standard Alabama Car Wheel	15 00@ 16 00
Tennessee " "	14 50@ 15 00
Lake Superior " "	13 50@ 14 00

OLD RAILS AND SCRAP METAL.

[Prices paid by mills.]

	Gross Tons
Old iron rails	$12 50
Old steel rails	10 00
	Net Tons
No. 1 R. R. wrought scrap	$ 9 00
No. 1 wrought scrap	8 00
No. 1 Machine cast scrap	8 00
Iron axles	14 50
Axle turnings	7 50
Wrought turnings (free from cast)	6 50
Cast borings	5 50
Uncut wrought iron boilers	4 00
Steel boiler plates	8 00
Grate bars	5 50
Pipes and flues (clean)	7 00
Tank iron	7 50
Hoop and band iron	6 00
Sheet iron	5 50
Wrought drillings	6 50
Malleable iron	8 00

STRUCTURAL MATERIAL.

Beams and Channels (Cleveland mill)	1.30c@1.35c
Angles	1.20c@1.25c
Tees	1.35c@1.45c
Universal Plates	1.20c
Sheared Plates	1.30c

MERCHANT IRON AND STEEL.

[List prices out of store.]

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 10
4½ to 6 by ⅜ to 1 inch	1 15
1½ to 6 by 1½ to 2 inch	1 30
1¼ & 1¾ by ⅜ to ¾ inch	1 15
1 & 1½ by ⅜ to ¾ inch	1 20
⅛, ¼, ⅜, by ¼ to ⅝ inch	1 30

Frank P. Cady, Pres. and Supt.
Geo. H. Bowler, Sec'y and Treas.

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283 W. River St., CLEVELAND, O.

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MILLING MINING AND AGRICULTURAL MACHINERY,

PERFORATED IRON, STEEL, COPPER, BRASS, TIN, ZINC, LEAD, ETC., TO ORDER.

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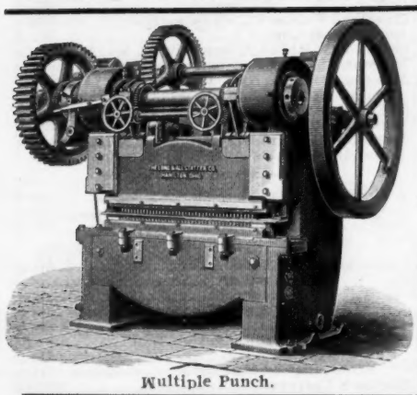

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HAMILTON, O., U. S. A.

Manufacturers of Belt, Steam and Electrically driven

Power Punches and Shears,

for all kinds of Boiler, Tank and Structural Iron Work, Rolling Mills, Locomotive Shops, Car and Wagon Shops, Plow Shops, etc. Send for catalogue.

A. H. LEITCH, PREST. JOHN C. LEITCH, SEC. AND TREAS.

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MANUFACTURERS OF HIGH GRADE **FIRE BRICKS.**

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DIXON'S PERFECT LUBRICATING GRAPHITE.

The most Marvelous Lubricant Known.
Used Dry, or Mixed with Water, Oil or Grease

NOT AFFECTED BY HEAT, COLD, STEAM OR ACIDS.

An Interesting and Instructive Pamphlet will be sent Free of Charge.

JOS. DIXON CRUCIBLE CO. Jersey City, N. J.

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.

CLEVELAND, OHIO.

Trade Mark Patented

ORDER DIRECT FROM THE

Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

Subscribe for the Iron Trade Review, $3 per year.

Round and Square.

1 to 1⅞ inch	1 10
2 to 2⅝ inch	1 20
2¾ to 3¼ inch	1 35
3⅜ to 4 inch	1 60
4⅛ to 4½ inch	2 20
4¾ to 5 inch	2 40

Oval.

⅜ to 1¼ inch	1 50
⅝ to ¾ inch	1 30
½	1 50
⅝	1 70

Half Oval and Half Round.

1¼ to 3 inch	1 65
⅜ to 1½ inch	1 45
⅝ to ¾ inch	1 70
½	1 85
⅝	2 95

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch	1 20
1 to 1⅜ by ¼ and 5-16 inch	1 25
¾ to ⅞ by ¼ and 5-16 inch	1 35
½ to ⅝ by ¼ and 5-16 inch	1 60

Hoop Iron.

1 7-16 to 4, No. 13, 14 15 and 16	1 65
1 7-16 to 2, No. 17, 18 and 19	1 70
1 7-16 to 2, No. 20	1 80
1 7-16 to 2, No. 21	1 90
1 7-16 to 2, No. 22	2 00
1⅛ to 1⅜, No. 13, 14 and 15	1 70
1⅛ to 1⅜, No. 16, 17 and 18	1 75
1⅛ to 1⅜, No 19 and 20	1 80
1⅛ to 1⅜, No. 21	1 90
1⅛ to 1⅜, No. 22	2 00
15-16 and 1 inch, No. 13, 14 and 15	1 65
15-16 and 1 inch, No. 16, 17 and 18	1 80
15-16 and 1 inch, No. 19 and 20	1 90
15-16 and 1 inch, No. 21	2 00
15-16 and 1 inch, No. 22	2 10
⅞, No. 13, 14 and 15	1 90
⅞, No. 16, 17 and 18	2 00
⅞, No. 19 and 20	2 10
⅞, No. 21	2 20
⅞, No. 22	2 30
13-16, No. 13, 14 and 15	2 00
13-16, No. 16, 17 and 18	2 10
13-16, No. 19 and 20	2 20
13-16 No. 21	2 30
13-16, No. 22	2 40
¾, No. 13, 14 and 15	2 10
¾, No. 16, 17 and 18	2 25
¾, No. 19 and 20	2 35
¾, No. 21	2 45
¾, No. 22	2 55
11-16, No. 13, 14 and 15	2 35
11-16, No. 16, 17 and 18	2 40
11-16, No. 19 and 20	2 50
1-16, No. 21	2 60
11-16, No. 22	2 70
11-16, No. 23	2 80
⅝, No. 13, 14 and 15	2 40
⅝, No. 16, 17 and 18	2 50
⅝, No. 19 and 20	2 60
⅝, No. 21	2 70
⅝, No. 22	2 80
⅝, No. 23	2 90
9-16, No. 13, 14 and 15	2 60
9-16, No. 16, 17 and 18	2 70
9-16, No. and 20	2 80
9-16, No. 21	2 90
9-16, No. 22	3 00
9-16, No. 23	3 10
7-16 and ½ inch, No. 13, 14 and 15	2 80
7-16 and ½ inch, No. 16, 17 and 18	2 90
7-16 and ½ inch, No. 19 and 20	3 00
7-16 and ½ inch, No. 21	3 10
7-16 and ½ inch, No. 22	3 20
7-16 and ½ inch, No. 23	3 30
⅜, No. 13, 14 and 15	3 30
⅜, No. 16, 17 and 18	3 40
⅜, No. 19 and 20	3 50
⅜, No. 21	4 80
⅜, No. 22	3 90
⅜, No. 23	4 05

Light Band.

1½ to 6 by ⅛ to 3-16 inch	1 40
1½ to 6 by Nos. 11 and 12	1 45
1 to 1⅜ by ⅛ to 3-16 inch	1 45
1 to 1⅜ by Nos. 11 and 12	1 50
⅞ and 13-16 by ⅛ to 3-16 inch	1 60
⅞ and 13-16 by Nos. 11 and 12	1 65
¾ and 11-16 by ⅛ to 3-16 inch	1 70
¾ and 11-16 by Nos. 11 and 12	1 75
⅝ and 9-16 by ⅛ to 3-16 inch	1 85
⅝ and 9-16 by Nos. 11 and 12	1 90
½ by ⅛ to 3-16 inch	2 00
½ by Nos. 11 and 12	2 05

Wagon Box Iron.

⅞ inch, beveled edge, by Nos. 11 and 12	1 60
⅞ inch, " " " 13 and 14	1 70
¾ inch, " " " 11 and 12	1 75
¾ inch, " " " 13 and 14	1 05

Sheet Iron.

No. 10	1 65
No. 12	1 75
No. 14	1 80
No. 15-17	1 90
No. 18	2 05
No. 20	2 20
No. 22-24	2 30
No. 25 26	2 40
No. 27	2 50

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 50
Shell	1 70
Flange	1 80
Marine Flange	2 10
Fire Box	3 00

Above includes plates 90 inches wide.

90 to 96 in. wide	½c. lb. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1½c. "
104 to 106 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs.
1 to 2 in. inclusive	08
9-16 to ½ in. "	08½

HOISTING MACHINERY

for Mining, Quarrying, Coal Handling, Pile Driving, Bridge Building, Log Hauling, and for general Contractors' Use. Improved Electric Hoists, single and double Patent Friction Drum, compound, geared with brakes and reversible for general Hoisting, Mining Purposes and Suspension Cable Ways.

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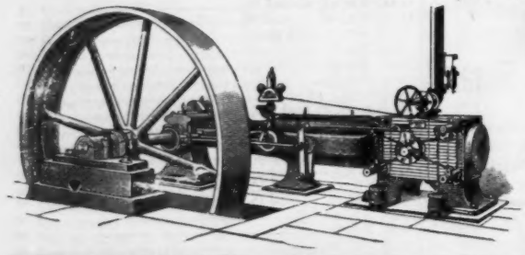
For moving all kinds of material in Steam Power Stations, Factories, Gas Works, Mines, Coal Yards, etc.

Tip Cars, Wire Rope, Barrows.

INDUSTRIAL RAILWAYS.

THE LANE & BODLEY CO.,

CINCINNATI, OHIO.



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ALL SIZES.

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Shafting, Hangers, Pulleys.

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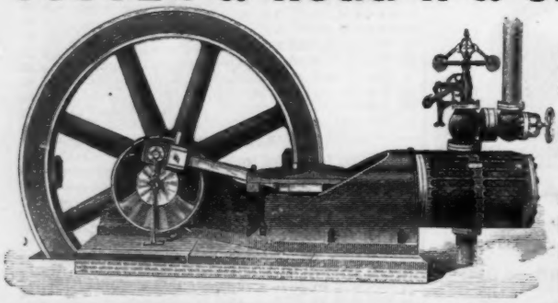

The "Ætna" Rolling Mill

ENGINE,

Chilled and Sand Rolls and Rolling Mill Machinery.

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Compare the analysis of the clay used in our.....

"O.K." CROWN

High Grade Fire Brick, with that used by ANY other Fire Brick-maker, and you will understand why, they have stood the TEST for TWENTY-TWO LONG YEARS

Our Prices are Just ...Right...

OAK HILL FIRE BRICK AND COAL CO.

MANUFACTURERS

OAK HILL, OHIO

7-16 to ⅜ and 2⅜ to 3 in.	.09
3⅛ to 4 in.	.09½
⅜ to 11-16 and 4⅛	.10
⅛ to 6 in.	.10½
¼ to 9-32 and 6⅛ to 7 in.	.11
16 in	.13
3	

Flats.

	cts. lbs.
2 to 9-16 in. wide by 2 to ⅜ thick	.8

Bessemer and O. H. Steel.

Machinery	base price,	1 50
Tire	"	1 60
Spring	"	2 10
Sleigh Shoe	"	2 00
Toe Calk	"	2 05
Cutter Shoes, tapered and bent	"	2 10

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 30
Bridge ½, ⅝, 11-16 and ¾ inch diam.	3 00

MACHINERY SUPPLY MARKET.

Anvils.

American	℔ 9@10
Wright's	℔ 12

Bellows.

Blacksmiths'	Hill's	dis 40
	Bullock's	dis 50&10
Moulders'		dis 40@40&10
Hand		dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70
" " " extra	dis 60&5
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 45
Shultz Raw Hide Leather Belting, single	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.,	dis 35
Buffalo	dis 40

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis 35
Horton's Universal	dis 40
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 20

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis 15
" " Gear Cutters	dis 15

Crowbars.

Cast Steel	℔ 3½
Iron, steel points	℔ lb 3

Drill and Drill Sockets.

Twist Drills	dis 50&10
Morse Taper and Straight Shank to 1½"	dis 50&10
Morse Taper and Straight Shank Larger than 1½"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 55@55&5
Cleveland " "	dis 55@55&5

Emery.

	No. 4 to No. 46 gr.	No. 54 to 150 gr.	Flour, C. F. FF.
Kegs, ℔	4½c	5 c	2½c
½ kegs ℔	4¾c	5¼c	2¾c
¼ kegs ℔	5 c	5½c	3 c
10 ℔ cans, 10 in case	6 c	6½c	5 c
10 ℔ cans less than 10	10 c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co.	dis 50@50&5
H. H. Barton	dis 50@50&5

Emery Wheels.

Detroit	dis 60@70
Norton's	dis 60@70
Grant	dis 60@70
Sterling	dis 60@70
Celluloid	dis 10&33⅓
Northampton	dis 55
Crystal	dis 65@70
Vitrified	dis 60@70
Vulcanite	dis 60&10
Hamden	dis 60&10@70
Cyclone	dis 60@60&10

Files.

Arcade	dis 60&10@60&10&10
Nicholson	dis 60&10@60&10&10
" X. F	dis 25
Kearney & Foot	dis 60&10@60&10&10
Black Diamond	dis 60&10@60&10&10
McClellan	dis 60&10@60&10&10
Disston's	dis 65@70

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BUILDING DEPARTMENT.

SPECIALTIES: STEEL AND IRON BUILDINGS FOR ROLLING MILLS, TIN PLATE PLANTS, STEEL WORKS, FOUNDRIES, FACTORIES, ROOF TRUSSES, GIRDERS, COLUMNS, BEAMS, CORRUGATED IRON, ETC.

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On your castings that you want removed?

If so,

Will clean them better than any other method.

Try It.

Chicago Chemical Solution Mfg. Co.
41 Lakeside Bldg., CHICAGO, ILL.

Cleveland Union Station.

Pennsylvania Lines.

Foot of Bank Street.

TICKET OFFICES at Station, Euclid Av., Woodland Av., and Weddell House corner.

THROUGH TRAINS RUN AS FOLLOWS BY CENTRAL TIME
* Daily. † Daily, except Sunday.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	† 7:00 am	†12:10 pm
Salem and Pittsburg	* 8:00 am	* 8:30 pm
Pittsburgh, Bellaire and East	†12:45 pm	† 6:25 pm
Philadelphia and New York	* 1:40 pm	*11:25 am
Baltimore and Washington	* 1:40 pm	*11:25 am
Alliance and Pittsburgh	* 1:40 pm	*11:25 am
Ravenna and Alliance	† 3:25 pm	† 9:50 am
Hudson and Ravenna	* 5:00 pm	* 8:25 am
Philadelphia and New York	*11:10 pm	* 5:25 am
Baltimore and Washington	*11:10 pm	* 5:25 am
Alliance and Pittsburgh	*11:10 pm	* 5:25 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8:40 am	* 5:15 pm
Akron and Columbus	* 8:40 am	*5:15 pm
Akron, Columbus & Zanesville	†12:45 pm	*12:10 pm
Akron and Orrville	† 3:25 pm	† 9.50 am
Columbus and Cincinnati	* 8:00 pm	* 6:55 am

Saturdays the 8:00 pm train will leave at 11:20 pm.

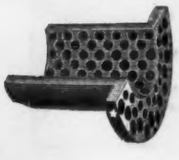
Valley Ry.

Depot foot of So. Water St.
City Office 137 Superior St.

	Arrive.	Depart.
Akron & Canton	*6:30 P M	*7:10 A M
Akron, Canton & Valley Jctn.	*10:10 A M	*3:15 P M
Valley Jctn. & Way Stations	†6:30 P M	†7:10 A M
Akron, Canton & Chicago	*8:00 A M	*6:30 P M
Wooster and Chicago	†2:45 P M	†11:00 A M
Wooster		†6:30 P M
Akron, Canton & Marietta	†2:45 P M	†11:00 A M
Steubenville, Wheeling, Washington, D. C., and Baltimore	†2:45 P M	†11:00 A M

†Daily except Sunday. *Daily. Pullman's Palace Vestibule Drawing Room cars between Cleveland and Chicago

OILLESS BEARINGS



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Atha new list, Jan. 15, 1887	dis 50
Heavy hammers and sledges under 5 lbs.	12c
" " " " over 5 lbs.	10c

Jack Screws.

Illinois Bolt Co. list	dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¾	4	3¾	3⅛
Hexagon	15⅛	11½	8½	6	5¾	5¾	
Washers	9	8	7	5	4⅝	4½	4½

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Medart Pulleys	dis 50
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Rivets.

Iron, Thousand, list November 1, 1894	dis 60@65
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894	dis 60@65
Copper	dis 50@50&10

Taps.

Cards, Hand and Nut to 2 in	dis 50
Carpenters' " " "	dis 50
Morse " " "	dis 50
Pratt & Whitney " " new list	dis 10
Machine Screw Taps	dis 55
Pipe Taps to 2½ in	dis 70
Stay Bolt Taps	dis 25
Stove Bolt Taps	dis 55
Pulley Taps	dis 40

Vises.

Solid Box	dis 60
Parker's	dis 20@25
Prentiss	dis 20
Stephen's	dis 25@30
Barrett's	dis 30
Miller's Falls	dis 40
Merrill's	dis 15@20
Howard	dis 35

Wire.

New List, Apr. 9, 1894

Brass	dis 40
Copper	dis 40
Bright and annealed, Nos. 0@18	dis 70&10@75
" " Nos. 19@26	dis 75@75& 5
" " Nos. 27@36	dis 75&10& 5
Coppered Nos. 0 to 18, market list	dis 70@70& 5
Galvanized Nos. 0 to 18 " "	dis65& 5
Tinned market Nos. 0 to 18	dis 57½
Cast steel	dis 50
Tinned Broom Wire	dis 70&5@70&10
Annealed Fence, Nos. 8 and 9	dis 75
Annealed Grape, Nos. 10 to 14	dis 75
Stub's Steel Wire regular	95c ⅛ lb dis 30

Wrenches.

Coe's genuine	dis 50
Girard Standard	dis 70&10
Agricultural	dis 75&10
Mechanic's	dis 55&10& 5
Bemis & Call's Combination	dis 35
Donohue's Engineers	dis 20&10
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William's " "	dis 25
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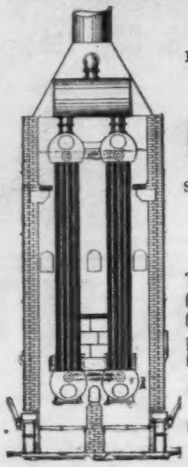

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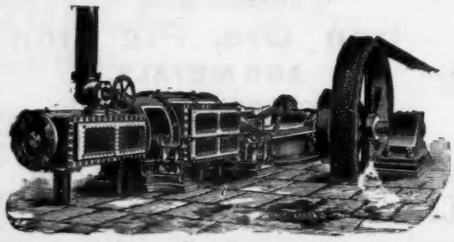

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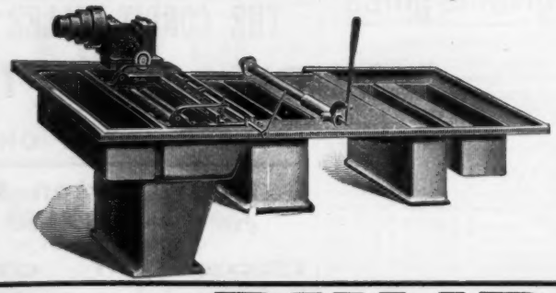

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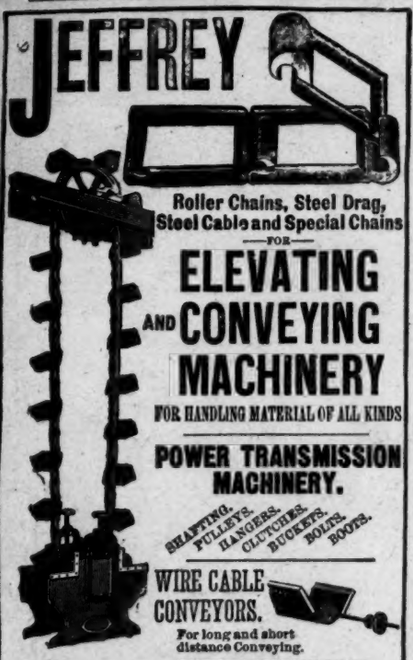

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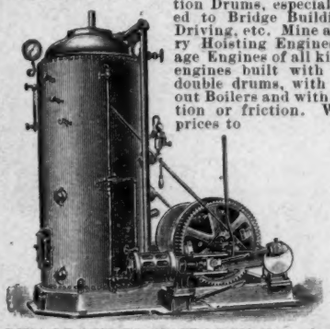

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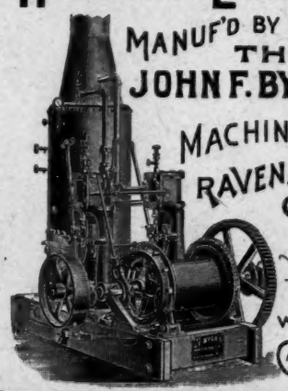

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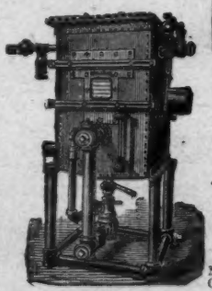

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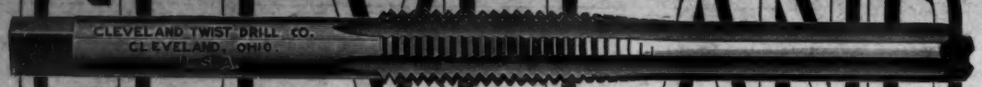

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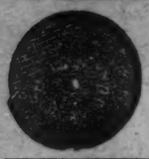

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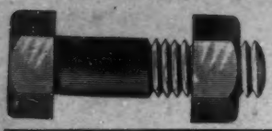

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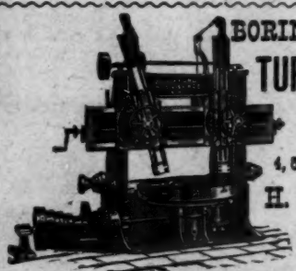

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